CDM

Dublin City Council

Further Characterisation/ Programmes of Measures

Urban Groundwater Pressures Assessment

March 2009

eastern river basin district

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

Final Report

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Acronyms

BAT – Best Available Technology

BMP – Best Management Practice

BTEX – Benzene, Toluene, Ethylbenzene, Xylene

CDM – CDM Ireland Ltd.

CFB – Central Fisheries Board

CSO – Combined Sewer Overflow

DAFF – Department of Agriculture, Fisheries and Food

DCC – Dublin City Council

DCENR – Department of Marine, Energy and Natural Resources

DEHLG – Department of Environment Heritage & Local Government

DWS - Drinking Water Standards

EA – Environment Agency (England and Wales)

EC – European Commission

EHS – Environment & Heritage Service (Northern Ireland)

EIA – Environmental Impact Assessment

EIS – Environmental Impact Statement

EPA – Environmental Protection Agency (Ireland)

EQO – Environmental Quality Objective

ERBD – Eastern River Basin District

FC – Further Characterisation

GDSDS – Greater Dublin Strategic Drainage Study

GIS – Geographic Information System

GSI – Geological Survey of Ireland

GWB – Groundwater Body

GWDTE – Groundwater Dependent Terrestrial Ecosystem

GWG – National Groundwater Working Group

GWS – Group Water Scheme

HSE – Health Services Executive

IEI – Institute of Engineers of Ireland

IGI – Institute of Geologists of Ireland

IGV – Interim Guidance Value

IPPC – Integrated Pollution Prevention Control

LSO – Less Stringent Objectives

LTG – Less Than Good

NFGWS - National Federation of Group Water Schemes

NI – Northern Ireland

NPWS – National Park and Wildlife Service

OOE – Office of Environmental Enforcement

OPW – Office of Public Works

PAH – Polycyclic Aromatic Hydrocarbons

PCB – Polychlorinated Biphenyls

PCS – Pesticide Control Service

pNHA – proposed Natural Heritage Area

POMs – Programme of Measures

PPA – Poorly Productive Aquifer

PWS – Public Water Scheme

QUB – Queens University Dublin

RBD – River Basin District

RBMP – River Basin Management Plan

ROI – Republic of Ireland

SAC – Special Area of Conservation

SEA – Strategic Environmental Assessment

SEPA – Scottish Environmental Protection Agency

SNIFFER – Scotland and Northern Ireland Forum for Environmental Research

SuDS – Sustainable Urban Drainage Study

SVOC – Semi-Volatile Organic Compounds

TCD – Trinity College, Dublin

TPH – Total Petroleum Hydrocarbons

UCC – National University of Ireland, Cork

UCD – National University of Ireland, Dublin

UCG – National University of Ireland, Galway

USGS – United States Geological Survey

UK – United Kingdom

UKTAG – UK Technical Advisory Group

VOC – Volatile Organic Compounds

WFD – Water Framework Directive

ZOC – Zone of Contribution

EXECUTIVE SUMMARY

A national further characterisation (FC) study of urban groundwater pressures has been carried out to support the Programmes of Measures (POM) phase of the Water Framework Directive implementation in Ireland. This follows an initial characterisation report which was prepared by the Environmental Protection Agency (EPA) and submitted to the European Commission (EC) in March 2005 (EPA, 2005a). The initial characterisation report included a risk assessment of all water bodies across Ireland, including groundwater. Urban areas were identified as a topic that would require further characterisation, with greater emphasis on identifying urban pressures and researching potential water quality impacts.

This FC study report explores environmental risk and impact to groundwater from urban pressures, with the following basic objectives:

1. Develop an improved description of groundwater pressures across urban footprints in Ireland;
2. Rank and group Irish urban areas according to specific groundwater pollution risk factors;
3. Describe the water quality of urban groundwater bodies (GWBs) using available datasets;
4. Identify suitable measures that will: a) improve the collective knowledge of urban groundwater pressures; and b) protect urban groundwater resources and associated receptors.

The study was carried out at a national scale, including 33 urban areas, defined as those having a population greater than 10,000 people based on the 2002 Census. As such, the study represents a bigger-picture assessment of urban groundwater pressures and impacts.

All urban areas pose a groundwater pollution risk. However, there are degrees of risk which are described and quantified by site-specific characteristics. These relate to pressures (sources of pollution), pathways (how pollutants may travel in the subsurface environment) and receptors (the presence or absence of human or ecological users of groundwater).

On the basis of a scoring and weighting methodology, several source-pathway-receptor attributes were assigned relative index values according to the relative magnitude of each attribute. The urban areas that are deemed to pose the greatest risk to groundwater are, unsurprisingly, some of the larger towns and cities in Ireland, including those that are associated with industry: Waterford, Dublin, Sligo, Limerick, Galway, Ennis and Drogheda.

A review of groundwater quality data indicates that urban pollutants are detected in a variety of urban settings across the country. There is some evidence of impacts from sewage, industrial activities, and waste facilities.

Because of limitations associated with existing datasets, broader conclusions about degrees and magnitudes of impact to groundwater quality can only be described for Waterford, Dublin, Drogheda and Swords. Results partly verify the risk assessment. From the available data, Waterford can be highlighted as a city where groundwater quality has been compromised over a wider area within the urban footprint. Area-weighted concentrations across the Waterford urban GWB exceeded drinking water standards for indicator parameters of urban pollutants such as ammonium, metals, and trace organic compounds. Waterford has several known point sources of pollution and traces of sewage-related compounds have also been detected in urban wells.

Across Dublin, the groundwater quality in the (deeper) Calp limestone has been impacted locally by industrial activity. Documented impacts are associated with industrial facilities which are under licensing review, investigation, or remediation. Shallow groundwater in the fluvio-glacial gravels underlying parts of Dublin's city centre shows signs of pollution from sewage and trace organics. Trace organics are primarily associated with past contaminated land sites along the Liffey and harbour area. While of limited extent, the shallow sands and gravels are in direct hydraulic communication with Dublin Bay and the lower Liffey. Groundwater hydraulics are strongly influenced by tides, and there is considerable mixing with seawater along the natural discharge zone between groundwater and seawater. The mixing implies a high degree of dilution. Compared to direct wastewater discharges and stormwater runoff, groundwater is considered to be a minor source of mass flux to Dublin Bay.

Data from Drogheda and Swords indicate localised impacts around industrial facilities or landfills, but few or no other problems on the wider urban groundwater body scale. In Cork and Limerick, industries are mostly located outside their immediate urban footprints, and while Cork has groundwater quality problems, these are associated with saline, tidal waters and past sewage-related impacts which will have been reduced by the recent completion of the Cork Main Drainage Scheme.

Groundwater quality impacts in most other towns can only be inferred as a general lack of urban data does not allow for similar conclusions to be drawn. However, where relevant samples have been taken, traces of pollutants can be found. This does not imply that the quality of groundwater resources in all towns is compromised. Urban groundwater pollution is a very site-specific science, and a great deal of additional study and monitoring would be needed to draw definitive conclusions about broader impacts across the country.

Urban groundwater is not an important source of water for public supply at the present time. Only three public supply wells in two towns, Portlaoise and Drogheda, pump groundwater from within urban footprints. Nearly half of the towns are also situated on rock types that are classified as "poorly productive" and are therefore unlikely to be exploited in the future for large public water supplies.

While few public supply wells exist within urban footprints, groundwater is used for industrial purposes, ranging from small car washing facilities to larger food processing plants. The full extent of industrial and commercial groundwater use in urban areas is not known. The locations of 55 wells have been verified through this study, but the actual number could be much higher. A survey of wells in urban areas is recommended, and known wells should be added to the national abstraction register developed as part of a different FC study on groundwater abstraction pressures (CDM, 2008c).

Ecological receptors of urban groundwater discharges are rivers, estuaries, and groundwater dependent terrestrial ecosystems (GWDTEs). The recent ecological status classification of surface water bodies compiled by the EPA indicates that several urban rivers and estuaries are impaired and of "less than good status" (as defined by the EPA). However, the sources of problems are primarily attributed to urban wastewater discharges and morphological pressures.

GWDTEs have been defined within three urban footprints; Maynooth/Leixlip, Galway, and Sligo. However, the only GWTDE that has been identified as being at risk from urban pressures is the Ryewater Valley (NPWS, 2008), a cSAC which is associated with the towns of Maynooth and Leixlip. The environmental supporting conditions for GWDTEs are generally poorly understood, and will be subject to considerable study and monitoring by the NPWS in the future.

From the review of pressures and impacts, recommendations for programmes of measures (POMs) have been developed to guide future urban groundwater protection. In the urban groundwater context, POMs are mitigation measures that would be required to ensure that WFD status objectives are met in all water bodies by year 2015, and that areas that are not yet impacted remain adequately protected from future water quality deterioration.

EPA's status classification of urban GWBs will drive the need for measures in any given town. The classification will partly be guided by this study. From the risk screening and review of available groundwater quality data, Waterford would probably qualify as a candidate for "less than good" (LTG) qualitative (chemical) status on the basis of several exceedances of EPA's status classification criteria for water quality. As such, Waterford would require site-specific measures targeting known pollution problems and overall aquifer protection goals. All other urban areas would be subject to the same pollution prevention measures and expanded monitoring.

There are numerous statutory instruments (acts, legislation) in place that are directly or indirectly protective of groundwater resources in urban settings. For example, under existing legislation, the EPA has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection. If fully (100%) implemented, the existing statutory instruments should be sufficient to eliminate point sources of pollution, at least those that are associated with EPA-licensed facilities. In practice, elimination of point sources of pollution is difficult to achieve due to accidental spills or poor handling practices by facility operators.

The review of pressures and water quality impacts in this study has uncovered several opportunities to improve the collective knowledge of urban groundwater characteristics across the country. These can be regarded as recommendations that would serve as supplementary measures to existing legislation. They fall into five broad classes, as follows:

- Surveys, mapping, and research;

- Codes of practice;
- Groundwater quality monitoring;
- Improved infrastructure;
- Planning.

The recommended supplementary measures address particular data and information gaps that have come to light during this FC study, and provide guidance as to how capture of such missing information would enhance the understanding of urban pressures, water quality impacts and environmental controls.

The recommended supplementary measures are summarised in **Table ES-1**. Many of the recommendations address data capture and reporting of environmental quality data. Others target research and surveys that are needed to verify or diminish existing perceptions of risk factors relating to diffuse pressures. As such, the urban groundwater study provides guidance as to the primary needs for improved environmental monitoring. Some of the needs will be addressed by the EPA as their enforcement and monitoring programmes evolve during subsequent River Basin Management cycles.

The list of recommended supplementary measures is long, and implementation will require time and coordination amongst the various stakeholders involved. Priorities can be argued, but certain activities can be implemented relatively quickly and with fewer requirements in terms of resources and funding. Overall, the target of measures should be an increased awareness of groundwater as a potential resource and as a potential pathway for pollutants to reach receptors. The documented water quality problems in Waterford are largely the result of urban development taking place with insufficient consideration of local hydrogeological conditions.

The future protection and management of urban groundwater resources in Ireland should evolve with greater awareness of the linkages between land use planning, drainage concepts, and water supply needs, even if the latter only applies to industrial and commercial activities. The means by which this can evolve is through environmental monitoring and enforcement, and importantly, making full use of asset management capabilities and data capture tools. Groundwater should be afforded a greater influence in urban development plans, at least where groundwater is an important natural resource for both humans and local ecology.

Table ES-1: Summary of Recommended Measures

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Source Factors			
Urban land use	Consistent classification scheme	• Standardise the procedures for the preparation and reporting of development plans; • Introduce standardised land use/zoning classification methodologies.	• Guidance
Transportation infrastructure	Access to GIS information and layers	• OSI agreements	• Modification to CCMA
Sewers	Asset management information	• Detailed mapping of sewage infrastructure – diameters, layouts; • Adopting and implementing the infiltration/exfiltration policies of the GDSDS (2005a); • Greater use of information management & and information management systems integration.	• GIS mapping; • IMS development and integration with GIS; • Code of Practice (GIS)
Sewers	Construction depths/levels	• Recording and reporting of completed new sewer details – diameters, depth profiles	• GIS mapping; • Code of Practice (GIS)
Sewers	Leaks (locations, nature)	• Recording and reporting of leaks and overflow incidents.	• GIS mapping; • Code of Practice (GIS)
Sewers	Extent of misconnections	• Survey of misconnections.	• Survey; • GIS mapping
Sewers	Exfiltration potential	• Development of exfiltration susceptibility maps.	• Surveys; • Mapping;
Sewers	Quality control (integrity)	• Prioritised supervision of construction; • Design provisions in groundwater vulnerable areas.	• Provision of adequate resources for local authorities; • Code of Practice (Design)
Industrial effluents	Discharge to sewer locations and volumes – volumes, water quality	• Mapping of industrial effluent.	• GIS mapping; • Code of Practice (GIS)
Underground storage tanks	Locations, volumes	• Registration of USTs.	• Registration; • GIS mapping
Pesticide use	Statistics of usage in domestic, amenity, and transport sectors	• Survey of pesticide sales and use.	• Survey; • Legislation – records of sale; • Legislation – summaries of usage

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Saline intrusion	Cases, extent	• Restrict abstraction and long-term dewatering schemes in coastal zones.	• Abstraction licensing
Pathway Factors			
Groundwater vulnerability	Groundwater vulnerability mapping	• Continued financial support for GSI's ongoing mapping programmes; • Expand GSI mapping to urban areas; • Reporting of vulnerability factors to the GSI by local authorities, geotechnical companies, consulting firms and/or developers.	• Funding for GSI mapping; • Code of Practice/implementing GSI Bill – submittal of information to the GSI
Preferential pathways	Well construction practices	• Ensure proper well construction with grouting seals; • Decommission abandoned wells that are no longer used and which are improperly constructed.	• Surveys of existing wells; • Decommissioning of relevant wells; • Enforcement of well construction practices
Receptor Factors			
Ecological receptors	Detailed mapping of GWDTEs and definition of supporting conditions	• Ecological and hydrogeological surveying	• Surveys; Monitoring
Ryewater SAC	Possible urban hydrological influence on the Ryewater GWDTE	• Hydrological study of environmental supporting conditions, and ecological status of the GWDTE.	• Survey; • Monitoring
Public supply wells	Zones of Contribution and Source Protection Zones	• Establish Source Protection Zones with expanded monitoring.	• Surveys; • Monitoring
Private abstraction wells	Locations, construction details, abstraction volumes	• Mapping and registration	• Survey; • Licensing
Water use	Degree of urban groundwater use in the foods industry	• Survey of foods industry; • Establish Source Protection Areas.	• Survey; • Expanded monitoring
Other			
IPPC and Waste licensed facilities	Monitoring wells	• Mapping and coding of wells.	• Survey; • Mapping; • Code of Practice (Facility reporting)
Groundwater quality data capture	Lack of consistency in reporting of water quality	• Minimum submittal requirements to EPA; • Standardise formatting of reporting; • Standardise detection limits to DWS and EQO requirements.	• Code of Practice (facility reporting); • License stipulations

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Groundwater quality data capture	Data review and assessment	• Directly link data submittals to EPA's EDEN database suite - applies to all data submitted for IPPC, waste, and contaminated land sites, and sources of water that are consumptively used.	• EDEN Integration Programme; • Code of Practice (new reporting structure and requirements for licensed facilities and local authorities)
Road Runoff	Impacts of road runoff on groundwater quality	• Quantify types and quality of runoff, and pollutant loading to groundwater at pilot test sites.	• Research
SuDS	Location, types	• Survey of existing large-scale SuDS schemes; • Registration of SuDS schemes	• Survey and database development; • Policy; • Legislation
SuDS	Groundwater quality impact	• Groundwater impact study in vulnerable area.	• Research; • Potential new legislation
SuDS Planning and Design	Hydrogeological factors	• Support development of the SuDS Evaluation Tool by expanding hydrogeological criteria.	• Technical input
Leaking sewers	n/a	• Sewer rehabilitation	• Investment programmes
Protection of public groundwater supplies	n/a	• Avoid construction of potential pollution sources within Source Protection Areas; • Introduce reinforced sewer construction practices within groundwater vulnerable zones.	• Code of Practice or Legislation; • Response matrices for construction of new sewers (see below)
Leaking water mains	n/a	• Leak reduction programmes; • Water conservation measures	• Surveys; • Investment programmes
Planning and land use zoning	Groundwater awareness in urban areas	• Training programmes for local authority planners; • Restrict development or set conditions for measures to protect groundwater resources in vulnerable areas (e.g., industry, high-density residential).	• Training; • Planning guidelines; • Public awareness
Enforcement	Enforcement of license conditions	• Stricter enforcement	• Provide adequate resources for EPA
Protection of urban groundwater resources	Lack of specific groundwater protection strategies in urban areas	• Develop groundwater protection strategies and measures.	• Development Plans; • River Basin Management plans
New sewer construction	Need to consider groundwater vulnerability in new sewer construction areas	• Develop groundwater protection response matrix, similar to work by GSI on landfills and septic systems.	• Response matrix of allowable construction and installation practices of new sewer networks

1. Introduction

1.1 Background

In March 2005, the Environmental Protection Agency (EPA) submitted a national characterisation report on Ireland's river basin districts (RBDs) to the European Commission (EC). The report entitled "The Characterisation and Analysis of Ireland's River Basin Districts" (EPA, 2005a) included risk assessments of environmental pressures on groundwater, including urban pressures. The report identified groundwater bodies which were deemed to be 'at risk' of failing to achieve the status objectives of the European Water Framework Directive (WFD) by year 2015. The report was synthesised from information provided by individual RBD projects, and represented the first of many formal deliverables to the EC by the Irish government as part of its implementation of the WFD.

A cursory review of the 2005 risk assessment for urban pressures would suggest that urban groundwater bodies are at considerable risk from meeting WFD objectives. However, the EPA and the national Groundwater Working Group (GWG) recognised that the methodology that was applied was overly conservative. It relied on qualitative information such as population thresholds and the simple presence or absence of certain pressure types as the basis for risk characterisation. Urban pressure information was not sufficiently available at the time and the test did not take specific account of source-pathway-receptor characteristics of individual urban areas. There were also no groundwater quality data available to verify the predictive risk assessment, as routine monitoring of urban groundwater has not yet taken place in Irish cities and towns.

Acknowledging these limitations, the Eastern River Basin District (ERBD) project was commissioned by Dublin City Council (DCC), on behalf of the Department of Environment, Heritage and Local Government (DEHLG), to study risk to groundwater from urban pressures in more detail as part of the Further Characterisation (FC) phase of the WFD.

The urban pressures study is one of many similar FC studies that are being carried out by the various RBD projects on a range of topics, including risk and impacts of onsite wastewater treatment systems, forestry, abstraction pressures, municipal and industrial discharges, pesticide applications, and dangerous substances. All FC studies are aimed at improving the current knowledge about environmental pressures, providing a baseline characterisation of "significant water management issues" (SWMI), and informing stakeholders about the subsequent selection of Programmes of Measures (POMs).

POMs are the primary mechanisms through which the objectives of the WFD will be achieved. POMs are to be implemented and reported by local authorities over successive 6-year River Basin Management Plan cycles. POMs will be designed both to improve polluted waters and to maintain good status waters according to environmental quality objectives (EQOs) and status classifications that have been defined by the EPA.

This report presents the findings of the national FC study on urban pressures that are specific to urban groundwater bodies. A separate but related study of urban pressures associated with urban surface water bodies is presently being finalised (CDM, 2008a).

1.2 Objectives

The primary objectives of the urban groundwater pressure assessment are as follows:

1. Develop an improved description of groundwater pressures across urban footprints of Ireland;
2. Rank and group Irish urban areas according to specific pollution risk factors;
3. Describe the water quality of urban groundwater bodies (GWBs) using available datasets;
4. Identify suitable programmes of measures to: a) improve the collective knowledge of urban groundwater pressures; and b) protect urban groundwater resources and associated receptors.

To arrive at the stated objectives, the following basic activities were carried out:

- Researching urban groundwater pressures and impacts around the world (literature review);
- Identifying and researching available information on urban pressures within 33 Irish towns and cities;
- Developing a "risk ranking" of Irish towns using source-pathway-receptor attributes for each town;
- Collating and describing existing groundwater quality data;
- Carrying out a sampling programme of selected wells in different towns;
- Assessing groundwater quality information and identifying pollution impacts;
- Summarising current legislation and best management practices that are relevant to the protection of urban groundwater resources;
- Identifying and describing supplementary measures that would be recommended to enhance existing knowledge of pressures and impact.

This FC study addresses risk of pollution in context of the 33 urban areas shown in **Figure 1 and Table 1**. These urban areas were included on the basis that their 2002 Census populations were greater than 10,000. Their urban footprints cover a total land area of approximately 1,000 km^2. Dublin is by far the largest footprint at over 431 km^2. Excluding Dublin, the average urban footprint size is only 17.5 km^2.

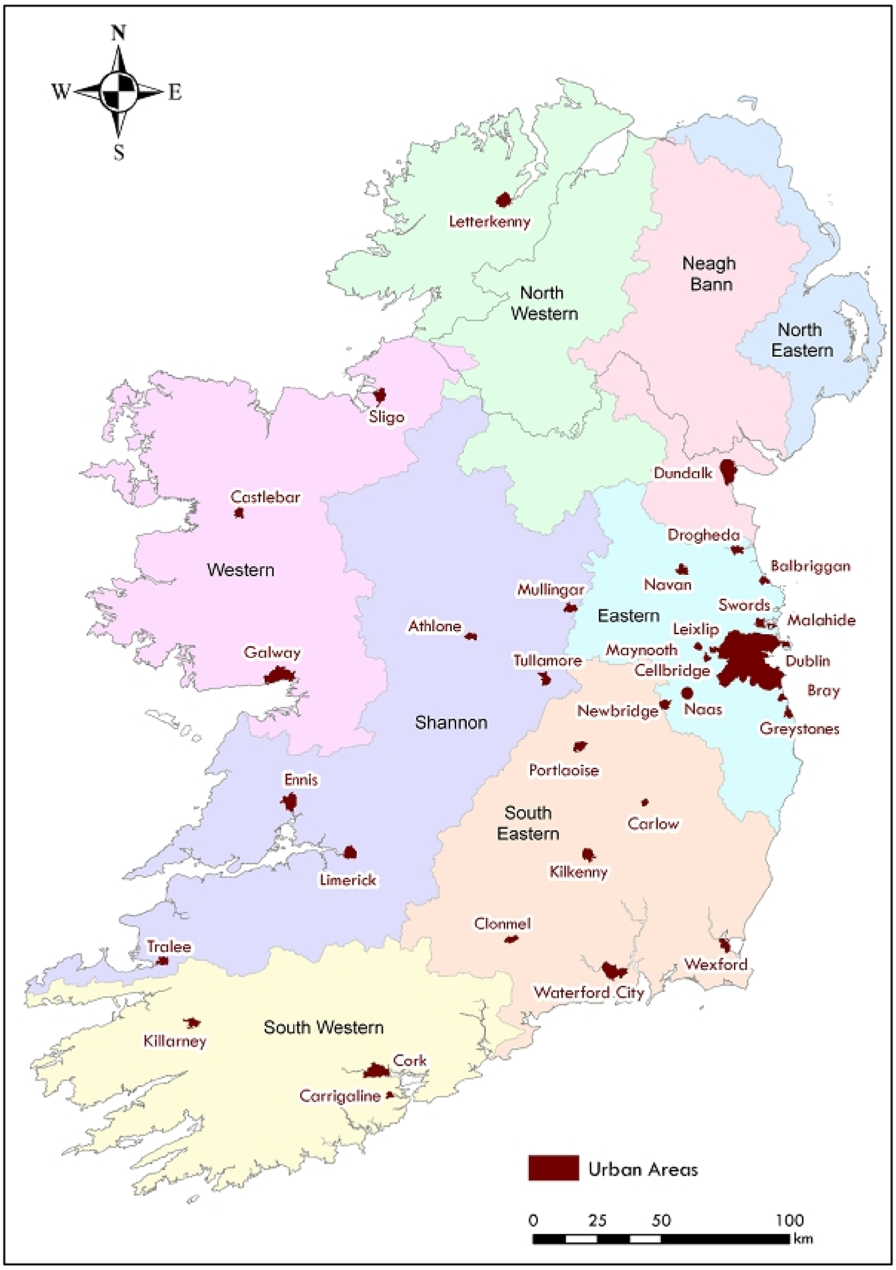

Figure 1: Urban Areas Included in Study

1.3 Steering Group

The project steering group was represented by following organisations: Dublin City Council (DCC); Department of Environment heritage and Local Government (DEHLG); Environmental Protection Agency (EPA); Geological Survey of Ireland (GSI); Trinity College Dublin (TCD); Northern Ireland Environment and Heritage Service (NI EHS); Wicklow County Council (WCC); Meath County Council (MCC); Department of Communications Energy and Natural Resources (DCENR) and the Southwestern River Basin District (SWRBD). The steering group was chaired by Mr. Don McEntee of DCC.

Table 1: Summary of Urban Areas Included in Study (Land use areas in Km^2)

Urban Area	River Basin	Population in 2002	Footprint Area	Town Centre	Residential	Heavy Industry	Light Industry	Mixed use	Commercial	Open space Managed	Open space Unmanaged
Athlone	Shannon	15,936	11.08	0.14	3.16	0.00	1.38	0.75	0.18	2.26	0.00
Balbriggan	East	10,294	8.93	0.37	1.27	0.00	0.94	0.03	0.00	3.63	0.02
Bray	East	30,951	7.50	0.28	3.99	0.00	0.33	0.76	0.00	0.61	0.78
Carlow	Southeast	18,487	6.54	0.53	2.16	0.00	0.68	0.66	0.00	0.52	0.00
Carrigaline	Southwest	11,191	5.95	0.06	3.11	0.00	0.21	0.13	0.00	0.22	0.00
Castlebar	West	11,371	11.81	0.41	3.37	0.00	0.28	0.54	0.04	1.24	0.00
Celbridge	East	16,016	7.26	0.00	2.15	0.00	0.09	0.26	0.09	2.52	0.00
Clonmel	Southeast	16,910	11.63	0.00	3.76	0.30	0.00	0.93	0.47	2.35	0.00
Cork	Southwest	186,239	39.47	0.01	20.68	0.59	1.14	1.83	1.12	6.22	1.01
Drogheda	East	31,020	13.37	0.36	4.85	0.00	2.49	1.30	0.00	1.39	0.00
Dublin	East	1,004,614	431.09	4.08	126.99	3.22	36.00	32.27	0.00	98.07	73.41
Dundalk	Neagh-Bann	32,505	46.22	0.52	8.34	0.06	0.85	8.18	0.05	6.84	1.26
Ennis	Shannon	22,051	29.71	0.69	8.91	0.00	0.38	0.62	0.54	4.80	0.00
Galway	West	66,163	50.54	0.33	14.93	0.00	2.26	3.03	1.42	22.95	0.00
Greystones	East	11,913	9.56	0.44	4.12	0.00	0.32	0.15	0.00	0.81	2.14
Kilkenny	Southeast	20,735	18.28	0.00	4.57	0.00	0.88	0.88	0.47	5.93	0.00
Killarney	Southwest	13,137	14.73	0.05	4.14	0.00	0.17	0.32	0.06	0.29	6.93
Leixlip	East	15,061	7.14	0.09	1.60	0.00	0.53	0.31	0.34	2.90	0.00
Letterkenny	Northwest	15,231	24.29	0.09	1.60	0.00	0.53	0.31	0.00	2.90	0.00
Limerick	Shannon	86,998	20.26	0.00	9.55	0.00	0.11	1.35	0.44	4.21	0.00
Malahide	East	13,826	4.67	0.15	2.87	0.00	0.00	0.03	0.00	0.39	0.04
Maynooth	East	10,151	7.21	0.32	1.52	0.00	0.02	0.76	0.00	3.05	0.00
Mullingar	East	15,621	13.79	0.32	3.18	0.00	0.33	0.82	0.24	0.39	1.38
Naas	East	18,288	18.30	0.35	3.69	0.00	0.61	0.43	0.08	8.49	0.00
Navan	East	19,417	15.10	0.49	4.06	0.28	0.07	0.82	0.00	1.16	0.71
Newbridge	East	16,739	13.94	0.43	2.64	0.00	0.41	0.24	0.00	4.24	0.00
Portlaoise	East	12,,127	16.44	0.51	4.58	0.00	1.20	0.76	0.16	1.28	0.00
Sligo	West	19,735	21.16	0.89	5.41	0.23	1.43	2.35	0.65	3.92	0.00
Swords	East	27,175	11.85	0.53	3.32	0.00	2.23	0.91	0.00	0.99	0.01
Tralee	Southwest	21,987	13.44	0.00	5.14	0.00	0.99	1.07	0.08	2.24	0.00
Tullamore	Shannon	11,098	15.89	0.00	3.21	0.67	0.04	0.59	0.50	0.25	0.26
Waterford	Southeast	46,736	41.65	0.29	6.85	0.00	3.43	2.14	0.00	13.63	3.35
Wexford	Southeast	17,235	14.66	0.66	3.51	0.00	0.55	0.78	0.00	3.59	0.00

1.4 Data Sources

To arrive at the stated objectives, numerous WFD participants and stakeholders have been consulted for information, input and review. The scope and findings of the study have also been presented to the project's Steering Group during early implementation.

Primary sources of data and information include: the Geological Survey of Ireland (GSI); individual River Basin District (RBD) Projects; Local Authorities; EPA; TCD; and the National Park and Wildlife Service (NPWS). Relevant literature is referenced as appropriate.

1.5 Acknowledgement

The authors wish to acknowledge the contributions of individual river basin districts in collating relevant data and information. The authors are especially indebted to the inputs from individual steering group members for direction and constructive review, notably Matthew Craig (EPA), Natalya Hunter Williams (GSI) and Bruce Misstear (TCD).

2. Urban Pressures and Groundwater

2.1 Introduction

The link between urbanisation and ground water pollution is universal, and the process of urbanisation impacts the quantity, distribution and quality of groundwater resources.

Because urban groundwater is a significant resource for water supply around the world, there is a considerable volume of literature which documents urban impacts on groundwater quality (e.g., Chilton et al., 1997l Ellis, 1999; Lerner, 2004; Reynolds, 2007). In Europe, approximately 40% water supplies are drawn from urban aquifers (Eiswirth, 2004), Hence, some of the most useful and detailed case studies of urban groundwater problems are from the UK and Germany. The European Commission is presently supporting a multi-year research effort in three European Union countries as well as Australia through a programme entitled "Assessing and Improving Sustainability of Urban Water Resources and Systems (AISUWRS; www.aisurws.de).

Impact of urban pressures on groundwater quality has received considerable scrutiny in the UK, with significant contributions from the Department for Environment Food and Rural Affairs (DEFRA) and the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). In the United States (US), similar work is led by the by the US Geological Survey (USGS) through the National Water Quality Assessment (NAWQA) programme.

2.2 Urban Groundwater Pressures

Urban groundwater pressures are location-specific and described by land use practices, infrastructure, and industrial and commercial activities. There are a large number of potential sources of pollution, with some that are specific to certain locations and others that are diffuse, i.e., occur over wider areas. DEFRA has developed significant literature on urban sources of pollution (DEFRA, 2004) and the Environment Agency (EA) has published numerous guidance notes on general pollution prevention measures.

In the Irish context, the basic components of urban groundwater pressures and associated water balances are summarised in **Figure 2.**

2.2.1 Sewer Networks

Most large urban areas have foul sewage collection systems. Sewage may pollute groundwater by exfiltration, which is the process by which sewage leaks from pipes as a result of physical breaks or degraded construction materials. Sewer lines tend to leak only if they are located above the groundwater table or if they are pressurised.

Misstear et al. (1996 and 1998) described sewer line failures as a function of sewer age in the UK. Most town centres in Ireland have old sewer systems. For example, the sewer lines in central Dublin are up to 100 years old and of known poor integrity.

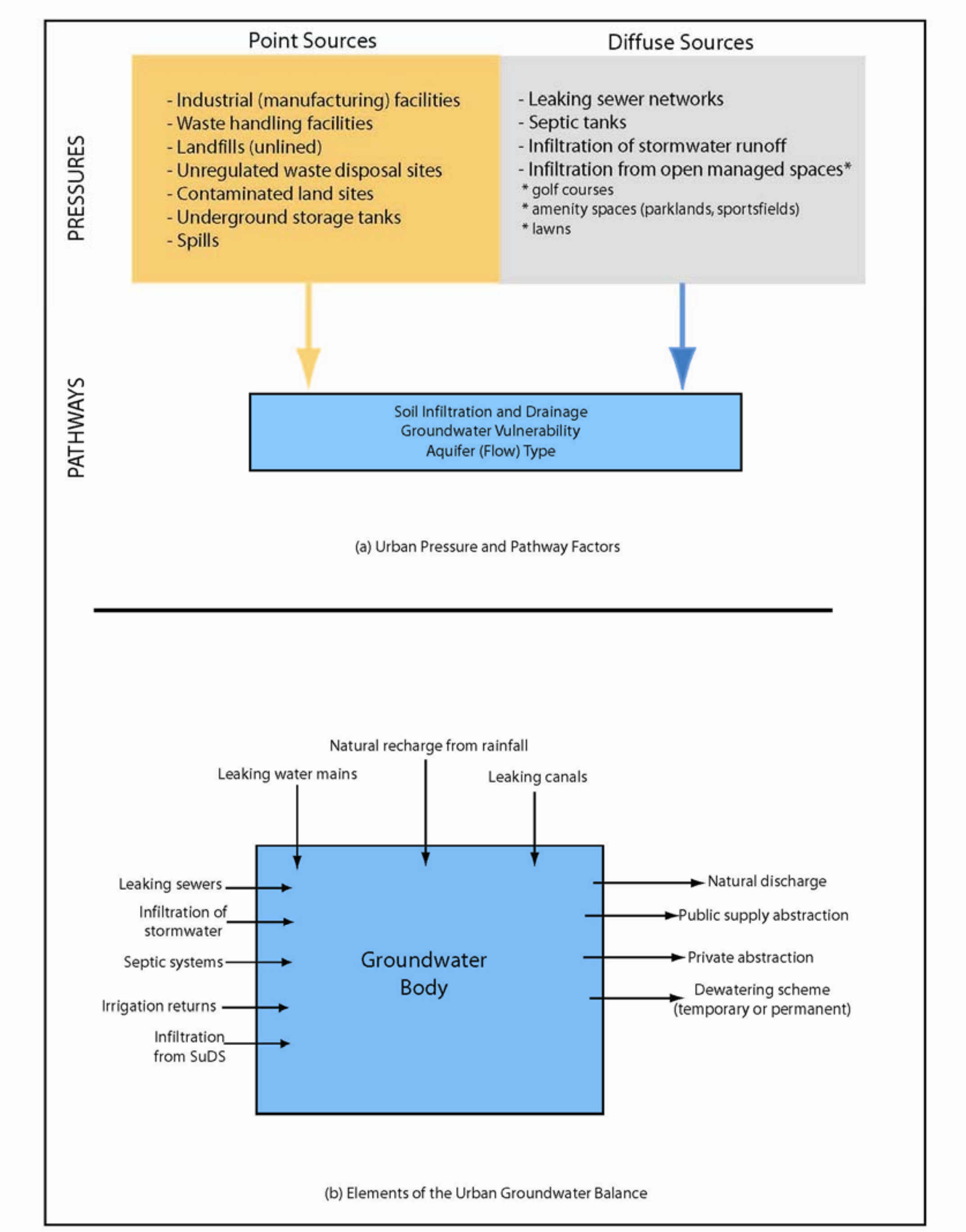

Figure 2: Urban Groundwater Pressures and Elements of the Urban Water Balance

Sewer density tends to be highest in town centres. Combined with the age factor, the risk of exfiltration is therefore expected to be greatest in town centres. While this may work as a general rule, leaks also occur in outlying areas. The main causes of sewer leaks are:

- Structural faults due to age, ground movement, or surface loadings;
- Inadequate designs and defects in construction;
- Operational faults, such as missing or damaged manhole covers.

A large number of new foul and storm sewer systems have been constructed in the past 10-20 years in line with Ireland's growth. Several local authorities have also undertaken city centre network improvements in recent years. It is widely perceived that given the rapid pace of development, the appropriate level of construction supervision may have been lacking.

Recent studies in the UK and Germany indicate that urban aquifers are potentially more vulnerable to contamination from leaking sewers than has been previously assumed. Cronin et al. (2005) describe frequent low-level detections of both bacterial and viral indicators of contamination at significant depths in urban aquifers in the UK. Held et al. (2007) describe groundwater contamination from broken sewers in Germany, with elevated concentrations of sewage indicators such as microbiological parameters. Quick fluctuations of electrical conductivity and groundwater levels have been correlated to exfiltration, and specifically to changes of the wastewater composition and the flow regime in sewer pipes.

While sewers leak, the degree of impact on groundwater quality is subject to some debate. Impacts vary as a function of wastewater composition and site-specific features that relate both to the physical nature of the leaks as well as local hydrogeology. Once in groundwater, wastewater compounds are influenced by physical-chemical processes such as filtration and adsorption, as well as biodegradation. Held et al. (2007) describes how pharmaceutical residues in shallow groundwater were not detected despite high concentrations of pharmaceuticals in the raw wastewater. Similarly, Eiswirth (1997) found groundwater deterioration was restricted to a narrow zone either side of sewer trench lines. Case studies of deeper sewage contamination tend to be ascribed to preferential pathways in fissured aquifers (Powell et al., 2003; Morris et al., 2005; Cronin et al., 2006) but this may be an over-generalisation as the fate and transport of pollutants are also influenced by a variety of non-geological factors.

The most significant sewer study in Ireland to date was carried out by DCC as part of the Greater Dublin Sewer and Drainage Study (GDSDS). The project completed CCTV inspections of sewers in many parts of Greater Dublin and carried out modelling of the entire sewer network to examine hydraulic performance. The reporting (GDSDS, 2005a concludes that "exfiltration is difficult to identify except where major pipe defects or breaks occur", and that leakages from damaged systems would tend to be masked by the much larger infiltration flows, which is regarded as a bigger problem nationally. While leaks were not specifically detected, the GDSDS concludes that "we can be confident that exfiltration is occurring in tandem with infiltration" (GDSDS, 2005a). The GDSDS further concluded that exfiltration flows were probably not identified due to flow monitor tolerances and the wide spread of monitoring locations.

A recent study by Queens University Belfast (QUB, 2006) described the presence of indicator species of sewage in groundwater in central Dublin (See Section 2 for details). Misstear and Bishop (1997) describe incidents of groundwater contamination from sewage in Naas and Nenagh. Similarly, KT Cullen & Co. (1994) references suspected sewage leaks as a potential source of trace organic contamination in wells near or within urban footprints.

In the UK, the potential dangers of sewer exfiltration have led the EA to oppose the construction of new sewer systems within its most vulnerable groundwater source protection zones (Misstear, 1998).

2.2.2 Industrial Facilities and Contaminated Land Sites

Industrial chemicals found in urban groundwater are either released accidentally from pipe leaks and spills or intentionally as a result of improper or illegal waste disposal practices.

Industrial facilities that use, process, or manufacture chemicals are licensed by the EPA under the Integrated Pollution Prevention Control (IPPC) licensing scheme. The overall aim of IPPC licensing is to prevent "emissions" (discharges) to the environment, including groundwater.

There are 519 IPPC licensed facilities across Ireland and their distribution is shown in **Figure 3**. 114 (22%) of the facilities are located within the 33 urban footprints included in this study. 73 of the 114 urban facilities are located in greater Dublin alone.

Several of the IPPC facilities are "active" contaminated land sites which are either undertaking remedial activities or monitoring, supervised by the EPA. Thirty-six contaminated land sites are located within the urban footprints included in this study, as shown in **Figure 4.** Under a separate FC study, the Shannon RBD project recently carried out a revised risk assessment of all contaminated land sites across Ireland. Of the 36 urban sites, 20 are deemed to be "at risk" of not meeting WFD status objectives in 2015 (ShRBD, 2008).

Most IPPC facilities and all (known) contaminated land sites are subject to environmental monitoring by the EPA. Fourty of the 114 (35%) urban IPPC facilities undertake groundwater monitoring on a scheduled basis. A summary of available data, sourced from EPA records, is provided in Section 4.

2.2.3 Waste Transfer and Disposal Facilities

There are 213 licensed activities in the waste sector, including landfills, transfer stations, hazardous waste disposal sites, as well as other significant waste recovery activities. Their locations are shown in **Figure 5**. Thirty-five of the 213 waste facilities are located within the 33 urban footprints included in the study, and 20 are required by EPA to carry out scheduled groundwater monitoring. A summary of available data, sourced from EPA records, is provided in Section 4.

Urban groundwater is at particular risk of pollution from direct discharges of liquid wastes and leachates from contaminated land sites and unlined landfills. Leachates from contaminated land sites are generated when infiltrating water or the groundwater table comes into contact with contaminated soils. Leachates from landfills originate from the decomposition of wastes in contact with infiltrating water. There are 17 landfills in the 33 urban areas included in the study, and eight of these are licensed by the EPA.

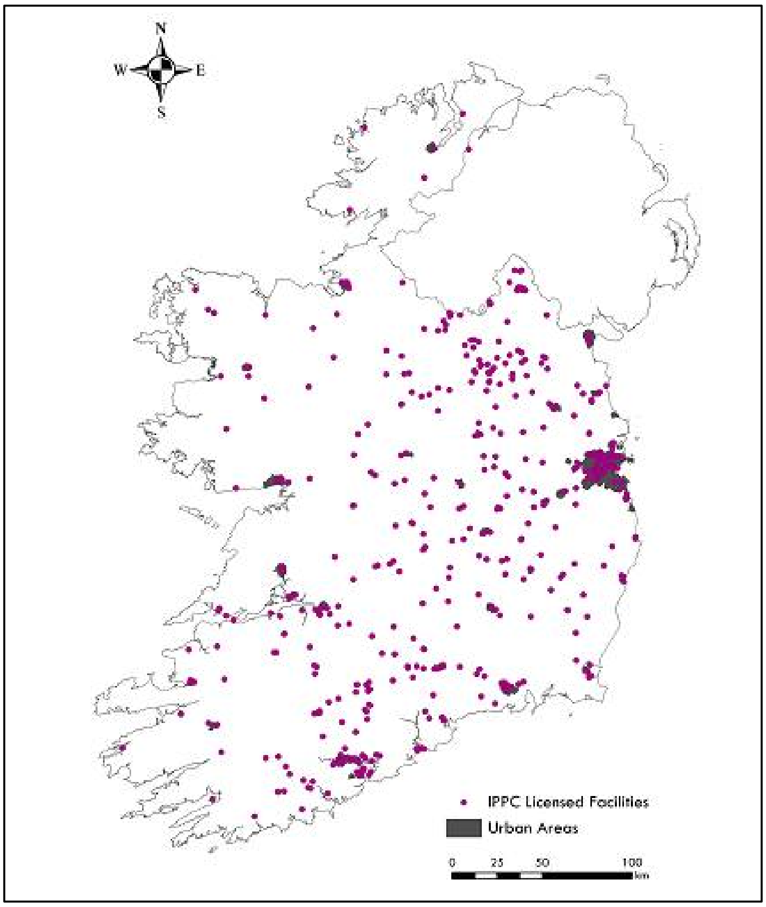

Figure 3: Distribution of IPPC Licensed Facilities

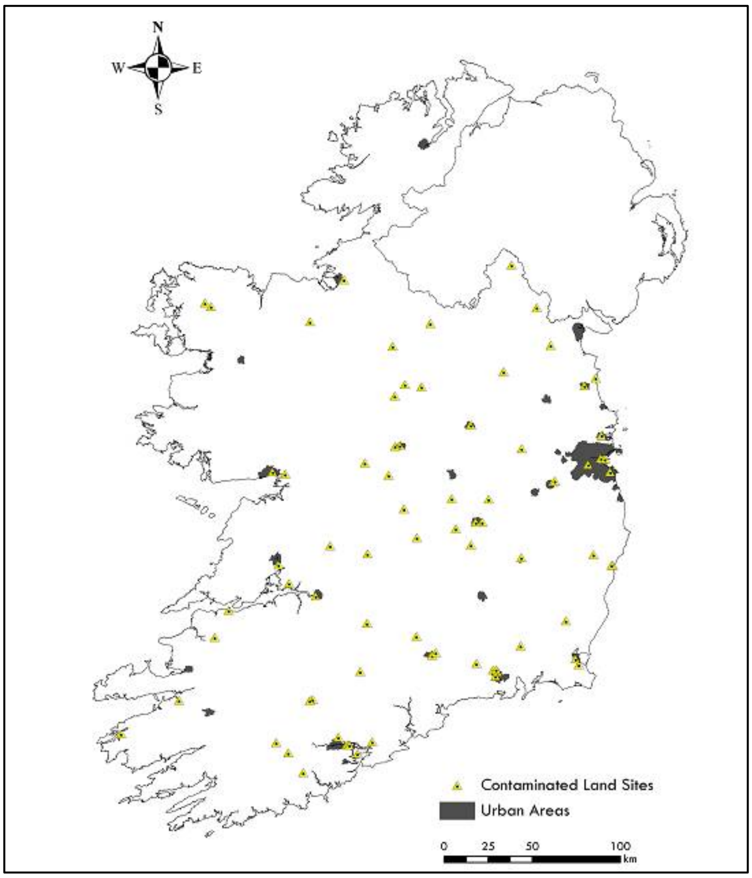

Figure 4: Contaminated Land Sites

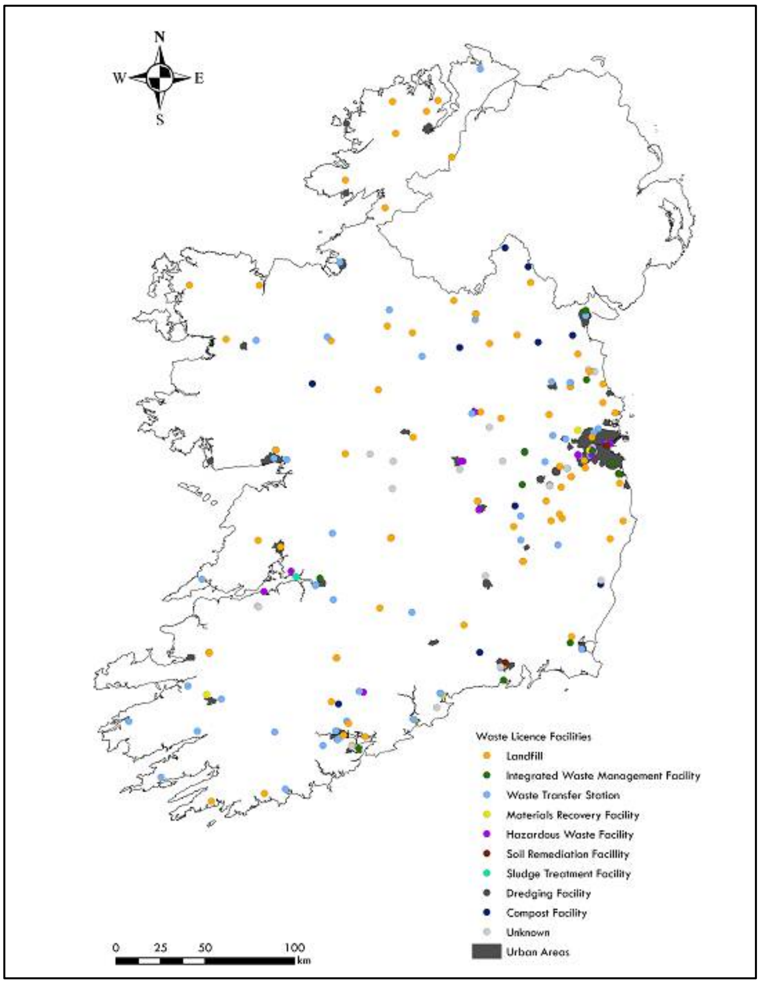

Figure 5: Distribution of Waste License Facilities

Unauthorised waste sites represent another potential source of groundwater pollution. Zhang et al. (2008) identified and mapped heavy metal pollution in soils in Galway associated with a former dump site near the city centre and adjacent to the Corrib River. Extremely high values of heavy metals were found, with maximum values of Pb, Zn, Cu and As of 10,297, 24,716, 2,224 and 744 mg/kg in soils, respectively.

There is no clear understanding of how many unauthorised waste sites may exist across the country, or how many are located within urban areas. Within the Dublin Region, fly-tipping “hotspots” have been identified by the EPA (2005b) including Dunsink Lane, Lynch’s Lane, Lucan and Killinarden, and Tallaght. An ongoing risk assessment programme is being carried out by local authorities to screen the need for detailed investigations of identified unauthorised waste sites.

2.2.4 Runoff

Urban runoff mobilises pollutants that accumulate on impermeable surfaces such as roads, car parks, and rooftops. Urban runoff is also generated during dry weather periods from washing of paved surfaces, car washing on hard surfaces, and waste tipping. Urban runoff commonly carries chemicals such as heavy metals, hydrocarbons, suspended solids, and faecal matter from animals.

A description of sources and chemical characteristics of urban runoff are presented in detail in the accompanying FC study on urban surface water pressures (CDM, 2008a). Pollutants associated with urban runoff are typically transported to storm drains and/or directly to local streams. However, urban runoff can also pond naturally (in topographic low points) or by design (e.g., stormwater detention). From here, pollutants can infiltrate through the soil to groundwater. Contaminants that are readily adsorbed to particulates (e.g., soil grains) are less likely to migrate into the subsurface than more soluble chemicals.

The impact potential of runoff pollutants on groundwater is site-specific. Runoff from roads and other paved surfaces can reach groundwater naturally through infiltration along verges of roads or deliberately through engineered drainage systems. The primary road drainage systems used in Ireland are filter drains, lined and unlined interceptor drains, soakaways (with or without outfall pipes) and shaped concrete channels (NRA, pers. Comm.).

No specific study of urban runoff impacts to groundwater have been carried out in Ireland, However, a comprehensive study on road runoff from motorways and potential impacts on receiving waters was recently completed by Bruen et al. (2006). The study determined the quality of motorway runoff under current road drainage design and maintenance practices at four sites on the M4 and M7 motorways for more than 42 storm events which were characterised, sampled and analysed for:

- Heavy metals (Cd, Cu, Pb, and Zn);
- 16 specified polycyclic aromatic hydrocarbons (PAHs);
- Volatile organic compounds including MTBE;
- A number of "conventional" pollutants, such as total suspended solids, total dissolved solids, etc.

In summary, the water quality of the motorway runoff showed elevated concentrations of total suspended solids (TSS), total organic carbon (TOC), heavy metals (Cu, Cd, Pb, Zn) and total phosphate (TP), in some cases exceeding the environmental quality standards that were used as a basis for comparing results. PAHs were also detected, though at lower frequency and at very low concentrations, generally < 1 ug/L. Regression analyses of runoff chemical data indicated a strong linear relationship between TSS and heavy metals. However, a strong relationship between pollutant concentrations and rainfall event characteristics was not found.

While groundwater was not specifically measured or monitored, the study included the sampling of drain materials at different depths from the surface. Pollutant concentrations from a kerb and gully drain system were consistently higher than samples from filter drains.

Filter drains were estimated to remove up to 98% of the TSS; 54% of the TOC; 88% of the TP, 99% of total Zn, 76% of total Cd, 73% of total Pb, and 83% of total Cu. However, sampling and visual observations of the drains indicated that incorrect construction and clogging of the drainage systems could have implications for pathways to receiving waters, including preferential pathways to groundwater.

Investigation of a 12-year old site on the M4 near Maynooth showed elevated concentrations of PAHs and heavy metals in soils adjacent to the road. The study specifically recommends a separate investigation of groundwater quality associated with runoff in areas of extreme groundwater vulnerability.

Actual impacts to groundwater will depend greatly on local hydrogeology. Where soils and subsoils are impermeable, and where groundwater occurs at some depth, the likelihood of impact decreases.

Mikkelsen (1997) describes accumulation of heavy metals and PAHs in the top 50 cm of runoff sludge in a 3 m deep, grass-covered depression receiving motorway runoff associated with traffic of 37,000 vehicles per day. The concentrations decreased rapidly immediately below the sludge. It was concluded that leaching of heavy metals is limited and that "contamination of potable groundwater with metals is of little practical concern within a reasonable time frame". The same conclusion was drawn for PAHs which typically adsorb readily to soil particles. However, the same study concluded that soluble components such as pesticides and trace organic compounds may pass directly through designed infiltration systems. Similar findings have been reported for soakaways by Pratt (1996).

Fischer et al. (2003) report increased detections of petroleum hydrocarbons and certain types of pesticides in wells located below stormwater detention basins compared to shallow wells located in surrounding areas. Patterns of volatile organic compound and pesticide detection in the basin groundwater reflected the land use in the drainage areas served by the basins.

Zhang (2006) describes relatively high concentrations of Cu, Pb and Zn in 166 soil samples collected along major traffic routes, old residential areas and the city centre of Galway, ascribing the detections to effects of traffic pollution. Cluster analysis classified 26 chemical elements into two groups: the first group predominantly derived from natural sources, the second being influenced by human activities.

Similarly, Paterson et al. (1996) described "enhanced contents" of Pb, Zn, Ba and Cu in urban soils collected from roadside locations in Aberdeen, and distinguished these chemically from samples collected in city parks.

The POLMIT project (POLMIT, 2002) investigated pollution emanating from roads at 14 test sites across Europe, and examined impacts on both soils and groundwater. Results are mixed, and although some problems associated with sample analyses are reported, low-level concentrations of both heavy metals and PAHs were detected in both soils and groundwater. However, elevated concentrations of metals were detected when road de-icing salts were applied, suggesting that salts facilitate the movement of adsorbed metals.

2.2.5 Transport Facilities

An exhaustive review of transport-related sources of groundwater pollution is provided by DEFRA (2004). These include roads, airports, petrol stations, vehicle repair shops, railway yards, etc. Infiltration of runoff from impermeable (paved) surfaces may act as diffuse sources of pollution, while spills and leaking underground storage tanks can act as discrete point sources of pollution.

A variety of activities occur at airports and railway yards, and groundwater pollution from both may exhibit many of the same characteristics of manufacturing sites, accidental spill sites, and fuel facilities. Historically, there are two major railway depots in Ireland; at Connelly station in Dublin, and in Portlaoise. The Connelly yard has a history of contaminated land. It was closed a few years back due to land constraints and rise in land prices in the area. The Portlaoise yard is still active and is the only active maintenance yard left in Ireland. There are 28 other storage locations associated with larger towns. These would be unlikely to store harmful materials as they are primarily intended for infrastructure items (Irish Rail, Pers. Comm., 2007).

Diffuse pollution associated with impermeable surfaces may originate as traffic emissions, vehicle and tyre corrosion, and abrasion of road surfaces and vehicle parts (such as brake pads and linings). Vehicles also leak small quantities of lubricating oils, coolant, and fuels directly onto the roadway or parking areas. Pesticides are believed to be used for weed control by most local authorities along road verges (CDM, 2008b), whereas the NRA indicates that weed-growth along national roads is primarily controlled by physical cutting.

2.2.6 Amenity Spaces

Amenity spaces are lawns, parks, and other managed green spaces such as golf courses and sports grounds. If applied to excess, pesticides and fertilisers may contribute to urban groundwater pollution. A review of pesticide pollution risk to groundwater (CDM, 2008b) suggests that herbicides are used by many different entities in urban settings, including local authorities (parkland management), the public (lawncare), and golf courses (maintenance of tees, greens and fairways). Quantitative data on usage are lacking, but low level detections of pesticides in groundwater can be expected where groundwater is extremely vulnerable and where highly mobile active ingredients (such as the triazine group chemicals) are used.

Ellis et al. (1997) estimated that pesticides (notably herbicides) from urban environments are responsible for up to 30% of drinking water exceedances in the UK.

In a detailed study of groundwater quality in the city of Montgomery, Alabama, pesticides and VOCs were detected more frequently and in greater concentrations in groundwater samples collected from urban wells compared to groundwater samples collected from rural wells (Robinson, 2003). The pesticides were mostly attributed to parkland maintenance and lawncare. Similar results are reported in Denver, Colorado (Bruce, 1995).

2.2.7 Commercial Activities

Commercial activities include all other potential pollution sources such as dry-cleaners, light-industrial estates, car-washing, vehicle maintenance facilities, and petrol stations. These are scattered throughout any given town, and would primarily dispose of waste products to storm drains. Petrol stations in particular can directly pollute groundwater if underground storage tanks leak. In the past, tank leaks could go unnoticed, but in the present day, petrol stations owners tend to follow EPA's Best Available Technologies (BAT) to reduce the risk of pollution, and tend to be subjected to periodic auditing and leak detection tests. Mapping of petrol stations is not available in existing local authority GIS systems.

2.3 Indicator Parameters of Urban Groundwater Pressures

Indicator parameters (or marker species) are chemical constituents or ingredients which, in theory, can be used to identify (or "fingerprint") different pressure types. For example, *E. Coli* in groundwater would be indicative of a human waste source such as sewage. **Table 2** summarises all pressure types and related parameters. For each category of urban pressures, there may be a large number of indicator parameters, or just a few. Studies carried out in the UK suggest that a multi-component approach is needed to distinguish between sources of pollution. While there are no single, proven methods of accurately identifying or quantifying any given source of contamination in groundwater, there are certain marker species which provide stronger evidence than others.

The bulk of research into suitable marker species for urban pressures relates to sewage-derived pollutants. This includes the fate and transport of:

- Nutrients (ammonia, nitrite, nitrate, phosphorus);
- Ions and minerals, notably boron;
- Bacteria and viruses (e.g., *E. Coli*);
- Brighteners (methyl blue active substances, or MBAS);
- Caffeine; and Pharmaceuticals.

Sewage is characterised principally by nitrogen and phosphorus compounds. There are no proven methods of accurately identifying or quantifying sewer exfiltration. Most biochemical markers are also present naturally in groundwater and may also occur in other sources of urban pollution (e.g., nutrient parameters could also be the result of fertiliser applications).

Nitrogen that infiltrates from raw sewage is normally in the form of ammonium. As it travels through groundwater, it may become reduced to nitrate and/or nitrite. Ammonium observed at high concentrations may therefore indicate proximity to a sewage source. Ammonium is oxidised to nitrite and nitrate as it migrates through soil or groundwater, depending on the redox potential of the matrix. As a result, when designing an urban groundwater monitoring programme, it is useful to measure the dissolved oxygen and redox potential of groundwater as well as concentrations of the individual nitrogen compounds.

Table 2: Urban Groundwater Pressure Types and Associated Determinands

Pollutant Categories and Specific Pollutants	Recommended Analytical Suite	Type 1 -- Leaking Sewers	Type 2-- Unlined Landfills	Type 3 -- Treated Effluent	Type 4 -- Catch-basins/ Runoff	Type 5 -- Manufacturing Sites	Type 6 -- Illegal Sewage Disch.	Type 7 -- Illegal Industrial Disch.	Type 8 -- Roads	Type 9 -- Petrol Stations	Type 10 -- Gas Works	Type 11 -- Accidental Spills	Type 12 -- Railway Yards	Type 13 -- Airports	Type 14 -- Septic Systems	Type 15 -- Other Leachates
Volatile organic compounds (VOCs)		(Chlorinated solvents, volatile petroleum hydrocarbons)														
-- Chlorinated VOCs (CVOCs)	**O6**															
Tetrachloroethene (PCE)	O6															
Trichloroethene (TCE)	O6															
cis-1,2-Dichloroethene (cis-1,2-DCE)	O6															
trans-1,2-Dichloroethene (trans-1,2-DCE)	O6															
Vinyl Chloride	O6															
1,1,1,2-Tetrachloroethane (1,1,1,2-PCA)	O6															
1,1,2,2-Tetrachloroethane (1,1,2,2-PCA)	O6															
1,1,1-Trichloroethane (1,1,1-TCA)	O6															
1,1,2-Trichloroethane (1,1,2-TCA)	O6															
1,1-Dichloroethane (1,1-DCA)	O6															
1,1-Dichloroethene (1,1-DCE)	O6															
-- Petroleum Hydrocarbons (PHC)	**O6**															
Benzene	O6															
Toluene	O6															
Ethylbenzene	O6															
Xylenes	O6															
Total Petroleum Hydrocarbons (TPH)	O6															
MTBE	O6															
Other VOCs	O6															
Semi-volatile organic chemicals (SVOC)	**O5**	(Generally these chemicals are industry-specific and need to be identified on case-by-case basis.)														
Phenols	O5															
Creosote	O5															
Coal tars	O5															
Other SVOCs	O5															
Polycyclic aromatic hydrocarbons (PAH)	**O7**	(Typically very limited mobility in the subsurface and groundwater.)														
Anthracene	O7															
Pyrene	O7															
Benzodifuran	O7															
Napthalene	O7															
Other PAHs	O7															
Metals	**I2, I3, I4**	(Metals in reduced oxidation states tend to be mobile in groundwater.)														
Iron	I2, I3															
Arsenic	I4															
Aluminium	I2															
Lead	I4															
Mercury	I4															
Silver	I2															
Zinc	I2															
Copper	I4															
Chromium	I2															
Cadmium	I2															
Cyanide	I4															
Other metals	I4															
Standard cations and anions	**I2**															
Chloride	I2															
Sulfate+Sulfite	I2															
Bicarbonate (alkalinity)	I2															
Sodium	I2															
Calcium	I2															
Manganese	I2															
Magnesium	I2															
Potassium	I2															

Urban Pressure Types																
Pollutant Categories and Specific Pollutants	**Recommended Analytical Suite**	**Type 1 -- Leaking Sewers**	**Type 2-- Unlined Landfills**	**Type 3 -- Treated Effluent**	**Type 4 -- Catch-basins/ Runoff**	**Type 5 -- Manufacturing Sites**	**Type 6 -- Illegal Sewage Disch.**	**Type 7 -- Illegal Industrial Disch.**	**Type 8 -- Roads**	**Type 9 -- Petrol Stations**	**Type 10 -- Gas Works**	**Type 11 -- Accidental Spills**	**Type 12 -- Railway Yards**	**Type 13 -- Airports**	**Type 14 -- Septic Systems**	**Type 15 -- Other Leachates**
Nutrients and Other Related Parameters	**I2**															
Nitrate	I2															
Nitrite	I2															
Ammonium	I2															
Total Organic Nitrogen (TON)	I2															
Total Kjeldahl Nitrogen (TKN)	I2															
Orthophosphate	I2															
Total Phosphate (TP)	I2															
Pathogens and other microbiological indicators (MBIO)	**M1**															
Faecal coliform	M1															
Total coliforms	M1															
E. coli	M1															
Viruses (enterococci, streptococci, etc.)	M1															
Disinfection by-products (trihalomethanes)	M1															
Field or probe-measured parameters (field)	**I1**															
pH	I1															
Specific conductivity (SC or EC)	I1															
eH (redox potential)	I1															
Temperature	I1															
Dissolved oxygen (DO)	I1															
Composite measures																
Total dissolved solids (TDS)																
Total organic carbon (TOC)																
Dissolved organic carbon (DOC)																
Chemical oxygen demand (COD)																
Biological oxygen demand (BOD)																
Pesticides and herbicides (PEST)		**(See CDM, 2007)**														
PCBs and dioxins (PCB/DIOX)	**O2**															
Tracers and Markers																
Boron	I2															
Fluoride	I4															
Gadolinium																
Fluorescing dyes ("Brighteners"/MBAS)																
Caffeine																
Pharmaceuticals and personal care products (PPCP)																
Carbamazepine																
Primidone																
Bezafigrate																
Clofibric acid																
Dicolfenac																
Propyphenazone																
Oxybenzone																

Phosphates relate principally to detergents, but phosphates tend to exhibit limited mobility in groundwater (exceptions exist). Boron is another detergent-related compound (Lerner and Halliday, 1994), but it is also derived from natural sources.

Cautions about interpretations of boron data are highlighted by Vengosh et al., (2005).

Microbial constituents in groundwater such as faecal coliforms and *E. Coli* are also indicators of sewage pollution. Other microbial indicators include thermotolerant coliforms, faecal streptococci, cryptosporidium, sulphite-reducing clostridia, as well as viruses such as coliphage and enteric viruses (Powell, et al., 2003).

Wolf et al. (2005) detected pharmaceuticals (including betablockers) in the urban groundwater of the city of Rastatt. The pharmaceutical group of iodated x-ray contrast media was also used to prove the presence of sewage in groundwater.

Cronin et al. (2006) conducted a study comparing several indicators of microbiological contamination in groundwater in Doncaster, UK. The study concluded that sulphite-reducing clostridia (SRC) and faecal streptococci were the two most promising microbial indicators of sewage impacts. Both SRC and faecal streptococci were detected in over 40% of samples analysed. The distribution of boron in the Doncaster study was found to support the results of the microbial analyses, despite uncertainties in the composition of laundry products (boron potentially accounts for 5-15 % of total detergent composition according to Barrett et al., 1999). The Doncaster study stressed the importance of combining several indicators in monitoring programs for sewage-derived pollution.

Local authorities throughout Ireland are presently undertaking risk assessments of individual water supplies in relation to cryptosporidium following a series of contamination events of public water supplies in the past few years. This includes groundwater. There are only three groundwater-based public supplies in the vicinity of the 33 urban areas included in this study, notably in Portlaoise (1) and Drogheda (2). While none of the supply wells show evidence of microbiological contamination, several other urban wells in Ireland show detections of *E.Coli* and total coliforms. Details are presented in Section 4.

2.3.1 Isotopic Fingerprinting

Fingerprinting approaches using stable and radioactive isotopes can be applied to characterise water and chemical transport through the unsaturated zone and in groundwater. Different isotopes tell different stories. Some are used to age-date water (e.g., carbon and hydrogen) whilst others serve to enhance the understanding of the origin and fate of different soluble chemical compounds in groundwater. Soluble compounds that are particularly relevant to urban groundwater studies are stable isotopes of oxygen, nitrate, boron, sulphate, chloride, bromide and dissolved inorganic carbon. These are all imprinted with an isotopic composition (a "fingerprint") that relates to the sources and processes that affect these compounds in groundwater. Details on isotope hydrology are available from a variety of information sources such as the International Atomic Energy Association (IAEA) and the USGS.

In the context of urban groundwater, the application of techniques involving nitrogen and oxygen isotopes have been used to differentiate between sources of nitrates such as sewage, fertilisers, natural soils, atmospheric deposition, and synthetic nitrates (Kendall and McDonnell, 1998). They have also been used to establish the degree by which natural processes such as denitrification influences nitrate concentrations in (urban) groundwater (Fukada et al., 2004). Hiscock et al. (1999) provided specific evidence of sewage contamination of groundwater beneath Liverpool using nitrogen isotopes. Similarly, Kracht et al. (2003) applied isotope chemistry to identify sources of pollution in a nitrate-contaminated aquifer in Brazil. Cronin et al (2005) describes the use of stable isotope ratios to constrain the wide range of potential sources that exist in groundwater beneath Doncaster and Nottingham, UK.

Isotope fingerprinting of groundwater will be increasingly relevant in Ireland as “conventional” monitoring data, notably nitrate data, are analysed and debated, and as monitoring programmes for urban areas are established for WFD purposes in the future. There are presently no accredited laboratories in the Republic of Ireland who can carry out isotopic analysis of water samples. The nearest accredited laboratory is at Queen’s University Belfast.

2.4 Urban Groundwater Pathways

Urban pollution can reach groundwater through a variety of direct and indirect pathways. Pathways relate to both the vertical movement of contaminants through soils and subsoils, as well as the subsequent lateral migration of contaminants in groundwater, which can be considered a horizontal pathway. Pathways can also be of an indirect nature, whereby pollutants migrate to groundwater and between aquifers as a result of man-made, engineered structures (e.g., building foundations, improperly constructed wells, etc.). Relevant pathway information that was considered in this FC study is described below.

2.4.1 Vertical Pathways

Vertical pathways are defined by flow of water through the subsoils above the aquifer and through the saturated zone in the aquifer. The dominant controls on flow are the thickness, type, texture and permeability of soils and subsoils, as well as effective rainfall. The unsaturated zone in bedrock aquifers plays a major part in transmission, but a very limited part in attenuation, of contaminants, since Irish bedrock aquifers are almost exclusively dominated by fracture flow. Thus, flow is rapid, even in partially-saturated conditions.

Teagasc recently published new soil and subsoil maps of Ireland which contain descriptors of type, texture and drainage characteristics (Teagasc, 2006). Relevant information on soil organic carbon ranges and relationships with soil texture classes have been the subject of work by Zhang and Moody (2004).

Subsoil characteristics are vital to the assessment of groundwater pollution risk. The term “vulnerability” is used by the GSI to denote the “intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities” (DELG/EPA/GSI, 1999). The national groundwater vulnerability mapping by the GSI provides an important indicator of pollution risk, and is closely linked to GSI’s existing groundwater protection schemes. The vulnerability assignment is based on the criteria reproduced in **Table 3**, which involve subsoil thickness, subsoil permeability, and depth to water (in sand and gravel aquifers).

Table 3: Criteria Used in Groundwater Vulnerability Mapping

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Source: GSI, 1999

Vertical movement of water is greater where soils are free draining and subsoils are permeable. Risk of pollution is greater where subsoils are thin or absent, and of higher permeability. Clayey subsoils reduce infiltration rates, increase (vertical) travel times and overall reduce the potential for pollutants to reach groundwater.

GSI's vulnerability mapping has been completed across 13 counties and is an ongoing activity. By the end of the first quarter of 2009, vulnerability mapping of a further 6 counties are scheduled to be completed. Between Teagasc and GSI mapping, soil and subsoil properties are reasonably well defined across Ireland. Some of the larger urban centres have not yet been investigated and so the resolution of mapping is lower.

Indications of vertical travel times through Irish soils are provided by Richards et al. (2005). Tracer experiments of travel times through the unsaturated zone were carried out at a location in Fermoy, Co. Cork using a bromide tracer. The site comprised a karstified limestone aquifer overlain by a thin (<2.5 m) free-draining overburden. This would be considered a highly vulnerable setting to groundwater pollution. The bromide tracer was detected after eight days in soil solution and 34 days in groundwater (sampled at two wells in the limestone). It was concluded that the transport of conservative pollutants such as nitrates would be expected to reach groundwater within a single "recharge season". The possible presence of preferential pathways would further raise concerns over rapid transport of non-conservative contaminants such as coliforms.

2.4.1.1 Preferential Pathways

Preferential pathways can enhance movement of water (and hence pollutants) through both the unsaturated and saturated zones. In the natural environment, preferential pathways are represented by macropores formed by fauna in the soil and root zones, inherent heterogeneity of subsoils, or by cracks and fractures resulting from geological processes (e.g., weathering). In urban settings, excavation and fill works may create or enhance preferential pathways whereby the natural characteristics of soils and subsoils are disturbed. Poor well construction practices, and/or use of abandoned wells to dispose of waste products, can also serve to act as conduits of flow to deeper aquifers.

A useful review of preferential pathways in the Irish context is provided by Daly (2002), Ryan (1998) and Tooth and Fairchild (2003). Daly (2002) suggested that natural "bypass flow" is unlikely to be significant below a few (3) metres depth in Irish subsoils. If this is correct, the groundwater vulnerability map of Ireland, reproduced in **Figure 6,** would provide important clues as to where the likelihood for preferential pathways would be greatest. Areas of extreme vulnerability (categories X and E in **Figure 6**) include areas where rocks either outcrop at the surface or are within 1 m of the ground surface (Category X) or are within 3 m of ground surface (Category E).

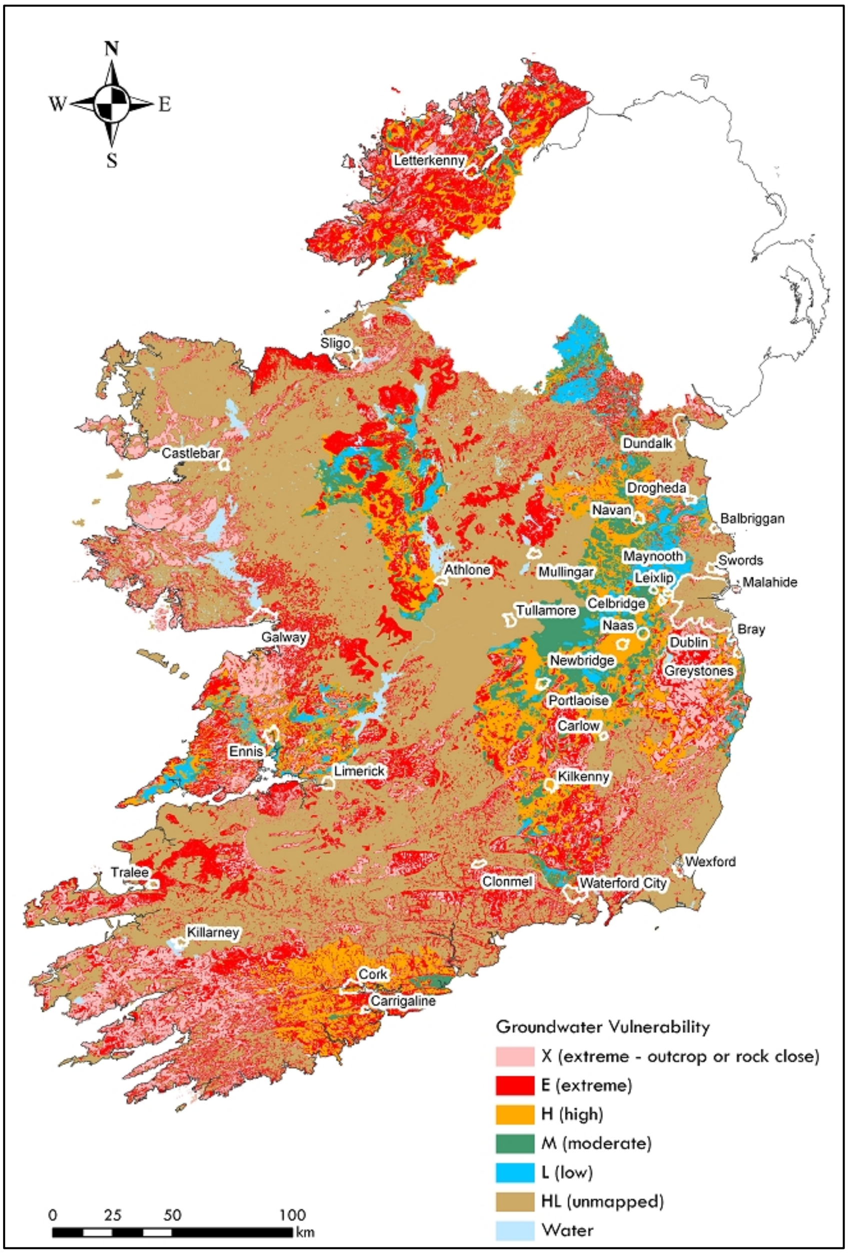

Figure 6: National Interim Groundwater Vulnerability Map (2007)

The potential presence of preferential pathways is also inferred from the national soil map produced by Teagasc, reproduced in **Figure 7**. Areas identified as "made ground" include soils that have been disturbed, and the majority of urban footprints are, unsurprisingly, defined by this category.

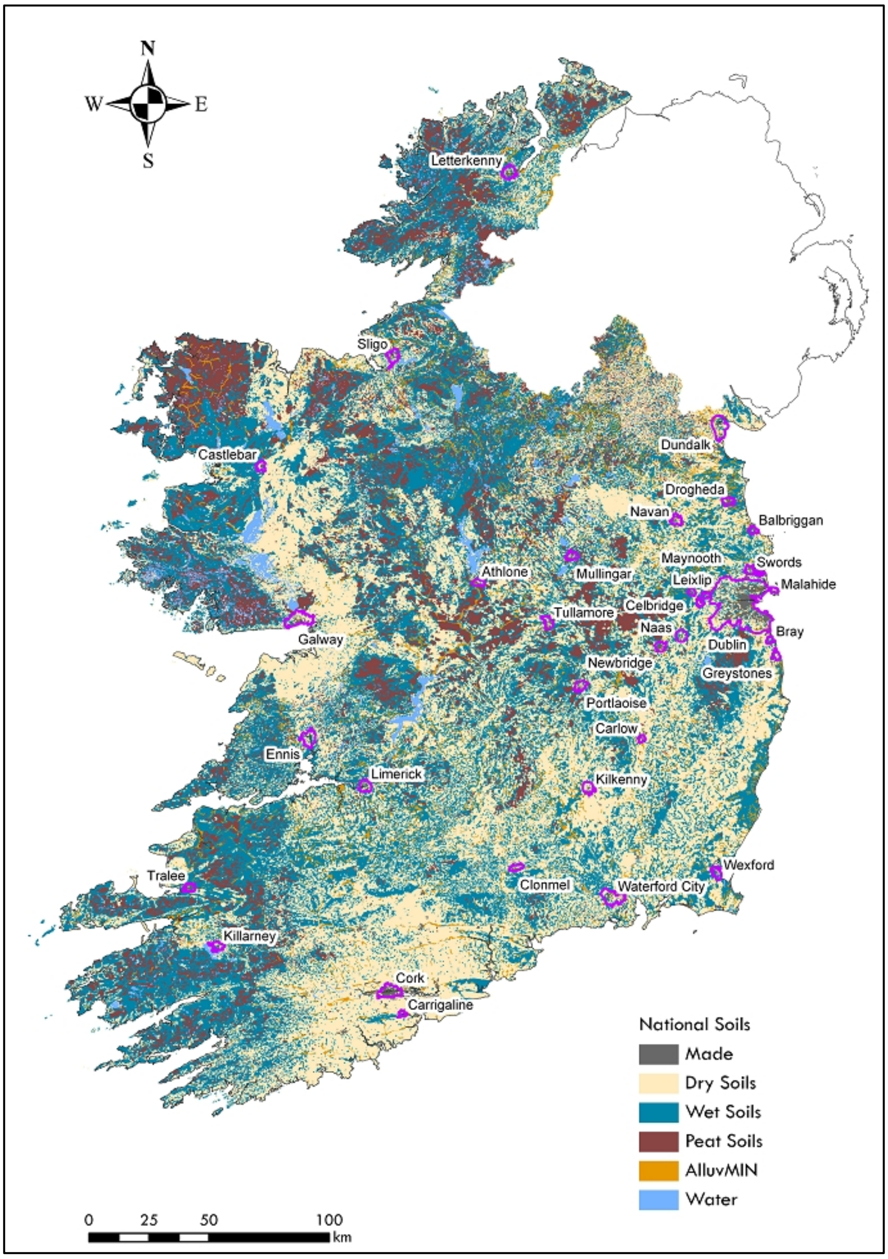

Figure 7: National Soil Map

2.4.2 Horizontal Pathways

Groundwater in the saturated zone flows according to prevailing hydraulic gradients and aquifer characteristics. Groundwater flow characteristics are influenced by a variety of factors, including the type of rock and its hydraulic properties at any given location. As part of the Groundwater Protection Scheme project (DELG/EPA/GSI, 1999), three main categories of aquifer relating to their resource value were defined by the GSI– Regionally important, Locally important, and Poor. These were further subdivided into aquifer classes according to the main type of groundwater flow (fissure flow, intergranular flow and flow through karstic conduits). For the purposes of the Water Framework Directive, WFD, the nine aquifer classes were simplified to four principal aquifer types, as shown in **Figure 8**:

- Karstic limestone aquifers;
- Fissured productive bedrock aquifers;
- Poorly productive bedrock aquifers;
- Sand and gravel aquifers.

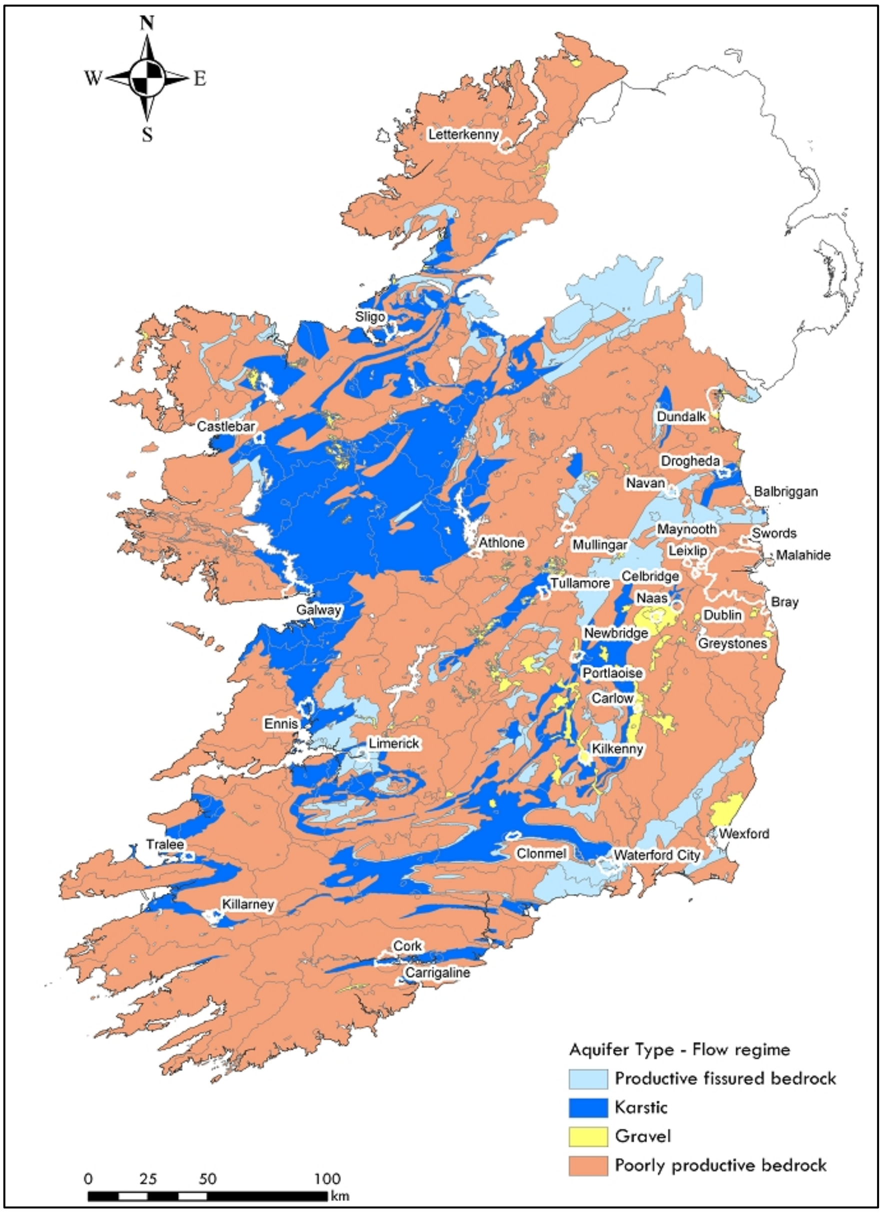

Figure 8: National Interim Aquifer Type Map (2007)

The key hydrogeological characteristics of these aquifer types are summarised in **Table 4.** There is an inferred hierarchy in terms of flow characteristics and resource value. Karstic limestone aquifers serve as a source of water for some of the largest groundwater supply schemes in the country and are of regional significance, whereas some bedrock aquifers are only locally important, serving as sources of water for smaller supply schemes and private wells. A common denominator between limestone and other bedrock aquifers is that groundwater flow is strongly influenced by heterogeneities, that is, changes in physical and hydraulic characteristics in three dimensions. The mapping of general aquifer types therefore serves as a general guide only based on the available information collated by GSI, and local differences may apply.

Table 4: Hydrogeological Characteristics of the Principal Aquifer Types

Aquifer Type	GSI Aquifer Classification	Hydrogeological Characteristics	Comment
Karstic Limestones	Rk_c, Rk_d, Rk, Rl	• Transmit large quantities of water very quickly in preferential subsurface channels (cave systems, solution openings). • Extremely high transmissivity, low storage, rapid groundwater flow velocities	• Regional significance except where limited areal extent (Lk); • Very important source of water for public supply; • Unpredictable flowpaths; • Unpredictable zones of contribution.
Fissured Productive Bedrock	Rf, Lm	• High transmissivity, low storage; • Flow occurs in discrete, interconnected fractures.	• Regional and local significance; • Important source of water for public water supply; • Zones of contribution strongly influenced by heterogeneities.
Poorly Productive Bedrock	Ll, Pl, Pu	• Low transmissivity, low storage; • Flow occurs in discrete, interconnected fractures;	• Regional significance due to spatial extent nationally, but groundwater catchments tend to be localised with flowpaths of a few hundred metres length only; • Shallow pathways important; • Important for small local water supplies; • Limited recharge capacity
Sand and Gravel Aquifers	Rg, Lg / unclassified S&G deposit	• Variable but overall high transmissivity, high storage, relatively slow groundwater flow velocities	• Mostly important as sources of water locally due to limited distribution nationally (the Curragh aquifer would be an example of a regionally important S&G aquifer); • Can provide high yields; • Predictable zones of contribution; • Provide additional transmissivity and storage to underlying bedrock aquifers where these are in hydraulic continuity. Not all water-bearing S&G deposits classified as aquifers within GSI mapping.

2.4.3 Pathway Summary

Table 5 summarises the spatial coverage of the main pathway factors in each urban area, using information from the available mapping of Teagasc and GSI. GSI's vulnerability mapping in urban centres has not yet extended to urban centres or densely built-up areas, and for such areas, a default "High-to-Low" category applies. For purposes of this study, a high vulnerability has been assumed in such cases, although it is recognised that this may overstate risk where vulnerability is actually lower. Conversely, risk may be understated where vulnerability is actually extreme.

Table 5: Summary of Soil Type, Groundwater Vulnerability, and Primary Aquifer Types Associated with Each Urban Area

		Soil Type (Km^2) [1]					Groundwater Vulnerability (Km^2) [2]						Geology [3]	
Name	Footprint area (km2)	Made	Well Drained Soils	Poorly Drained Soils	Alluvial Soils	Peat	X-Extreme	E-Extreme	High	Moderate	Low	High to Low	Primary Aquifer Category [4]	Primary Rock Unit
Athlone	11.08	4.77	2.57	1.08	1.21	1.11	0.00	0.00	0.01	0.00	0.00	10.74	Ll	Dinantian Pure Unbedded Limestone
Balbriggan	8.93	1.69	1.18	5.77	0.28	0.00	0.16	0.67	0.00	0.00	0.00	8.1	Lm	Ordovician Volcanics
Bray	7.50	4.82	0.89	1.39	0.29	0.00	0.83	1.45	1.68	0.97	2.49	0.09	Pl	Cambrian Metasediments
Carlow	6.54	4.06	2.04	0.01	0.43	0.00	0.09	0.35	0.01	0.01	0.00	6.08	S&G	S&G on top of Dinantian Dolomitised Limestone
Carrigaline	5.95	2.32	1.27	1.97	0.20	0.00	0.15	2.43	3.21	0.00	0.00	0.16	Ll	Dinantian Pure Unbedded Limestone
Castlebar	11.81	3.66	2.97	3.58	0.00	1.17	0.17	0.59	0.00	0.00	0.00	10.63	Rk_c	Dinantian Pure Bedded Limestones
Celbridge	7.26	2.50	3.21	1.29	0.27	0.00	0.07	0.17	6.41	0.62	0.00	0.00	Ll	Dinantian Upper Impure Limestones
Clonmel	11.63	4.93	5.16	0.71	0.83	0.00	0.37	1.96	0.00	0.00	0.00	9.30	Rk_d	Dinantian Pure Unbedded Limestone
Cork	39.47	32.77	3.99	0.35	1.12	0.00	1.32	12.17	24.44	0.15	0.00	1.35	Rk_d	Dinantian Pure Unbedded Limestone
Drogheda	13.37	6.67	0.53	5.02	0.66	0.00	0.74	0.66	0.01	0.01	0.20	10.99	Rk_d	Dinantian Pure Bedded Limestones
Dublin	431.09	219.11	139.40	52.53	7.03	0.18	28.03	24.89	0.00	0.04	0.06	369.10	Ll	Dinantian Upper Impure Limestones
Dundalk	46.22	10.36	23.24	8.09	2.79	0.00	1.47	6.73	0.00	0.00	0.00	36.35	Pl	Silurian Metasediments and Volcanics
Ennis	29.71	6.30	15.34	5.92	0.92	0.98	8.19	4.82	14.70	1.22	0.04	0.47	Rk_c	Dinantian Pure Bedded Limestones
Galway	50.54	15.66	27.46	3.99	1.46	0.71	12.07	16.43	0.00	0.00	0.00	20.99	Pl and Rk_c	Granite and Dinantian Pure Bedded Limestones
Greystones	9.56	4.04	3.08	2.22	0.22	0.00	0.65	1.96	5.63	1.32	0.00	0.00	Pl	Cambrian Metasediments
Kilkenny	18.28	6.64	10.12	0.49	0.95	0.07	0.43	0.64	17.12	0.02	0.07	0.00	S&G	S&G on top of Dinantian Pure Bedded Limestones
Killarney	14.73	5.34	4.79	2.20	2.36	0.00	0.15	0.43	0.00	0.00	0.00	14.13	Rk_d	Dinantian Pure Unbedded Limestone
Leixlip	7.14	2.57	1.79	2.40	0.38	0.00	0.10	0.32	4.50	2.21	0.00	0.00	Ll	Dinantian Upper Impure Limestones
Letterkenny	24.29	4.92	1.82	14.27	3.06	0.23	3.49	14.71	6.09	0.00	0.00	0.00	Pl	Precambrian Quartzites, Gneisses and Schists
Limerick	20.26	13.58	1.95	3.79	0.00	0.00	0.61	0.63	0.03	0.00	0.00	18.08	Lm	Dinantian Pure Bedded Limestones
Malahide	4.67	2.83	1.15	0.40	0.22	0.00	0.20	0.67	0.00	0.00	0.00	3.75	Ll	Dinantian Lower Impure Limestones
Maynooth	7.21	2.48	1.50	2.82	0.41	0.00	0.02	0.08	2.74	4.29	0.08	0.00	Ll	Dinantian Upper Impure Limestones
Mullingar	13.79	4.60	6.47	1.29	0.14	1.30	0.09	0.34	0.00	0.00	0.00	13.37	Ll	Dinantian Upper Impure Limestones
Naas	18.30	4.89	7.13	5.31	0.95	0.01	0.12	0.26	8.76	8.31	0.86	0.00	Ll	Impure Limestones
Navan	15.10	4.19	9.19	1.21	0.34	0.00	0.38	0.92	7.41	6.22	0.00	0.00	Lm	Dinantian Upper Impure Limestones
Newbridge	13.94	3.85	7.03	1.19	1.86	0.01	0.00	0.02	13.92	0.00	0.00	0.00	S&G	S&G on top of Dinantian Pure Bedded Limestones
Portlaoise	16.44	4.03	5.72	5.25	1.24	0.20	0.09	0.14	9.22	6.99	0.00	0.00	Rk_d	Dinantian Pure Bedded Limestones
Sligo	21.16	5.93	11.33	1.35	1.36	0.43	0.80	1.49	0.00	0.00	0.00	18.25	Rk_c	Dinantian Pure Bedded Limestones
Swords	11.85	5.05	4.82	1.43	0.55	0.00	0.00	0.01	0.00	0.00	0.00	11.81	Ll	Dinantian Lower Impure Limestones
Tralee	13.44	6.56	1.92	4.19	0.71	0.00	0.25	3.03	0.00	0.00	0.00	10.16	Rk_d	Dinantian Pure Unbedded Limestone
Tullamore	15.89	4.12	6.34	2.75	2.16	0.51	0.00	0.00	0.00	0.00	0.00	15.89	Rk_d	Dinantian Pure Bedded Limestones
Waterford	41.65	11.33	19.70	4.87	2.49	0.10	2.96	9.95	0.00	0.00	0.00	25.58	Rf	Cambrian Metasediments
Wexford	14.66	4.71	4.52	4.94	0.31	0.00	1.07	2.86	0.00	0.00	0.00	10.55	Pl	Ordovician Volcanics

Note:
[1] – soil information taken from national mapping by Teagasc (2006a).
[2] – vulnerability information is taken from most recent GSI national map of groundwater vulnerability (GSI, 2007).
[3] – geological information is taken from GSI national coverages of aquifer types.
[4] – some towns are underlain by more than one aquifer type, and only primary one is listed

Fifteen of the 33 towns are underlain by poorly productive bedrock aquifers, whereas 14 towns are underlain primarily by karstic limestones. Three towns (e.g., Carlow, Kilkenny, and Newbridge) are underlain almost entirely by sand and gravel aquifers. Some towns are underlain by more than one aquifer type. For example, in Galway, granites (aquifer type Pl) underlie the city to the west of the Corrib River, and karstic limestones (aquifer type Rk_c) are found to the east of the Corrib River (the karst being part of the Lough Corrib natural drainage system). The type of bedrock that underlies a town has implications for mixing and attenuation of pollutants in groundwater.

2.4.3.1 Mixing and Attenuation

Upon reaching the water table, pollutants mix with groundwater. Mixing is a transient process of dilution. The degree of mixing that occurs is a function of mass loading (volume, concentration, time), volumetric rate of groundwater inflow (from upgradient areas), natural background concentrations in groundwater, and aquifer properties.

Some aquifers transmit water at higher volumetric rates than others. This implies: a) greater mixing (i.e., dilution); and b) faster migration in higher transmissivity aquifers. Using the broad aquifer types described in Section 2.4.2, mixing in karstic aquifers would be highest and mixing ratios in poorly productive aquifers would be lowest. There are grey areas in between these end-points, driven by site-specific hydrogeological characteristics.

Following mixing, pollutants flow under prevailing gradients towards discharge areas or abstraction points. During migration, chemicals will attenuate differently as a function of volumetric flow rates and physical-chemical interactions in the groundwater-bedrock system.

The natural attenuation potential in karstic and fissured bedrock aquifers would generally be considered lower than in sand and gravel aquifers. Urban areas overlying sand and gravel aquifers may be vulnerable to pollution, but once in groundwater, the risk of pollutants reaching wells and ecological receptors is reduced as travel times tend to be slower and pollutants have a greater opportunity to degrade.

2.4.3.2 Groundwater Flow in Poorly Productive Aquifers

Certain volcanic and metamorphic rock types have been classified as Ll, Pl and Pu aquifers (see Table 4 for details), which together form the group of "poorly productive aquifers" (PPAs). These rocks represent a particularly challenging hydrogeological environment, and they are particularly relevant as they cover more than two-thirds of the land area of Ireland, and partly or wholly underlie 15 of the 33 towns included in this study.

Groundwater flow systems in PPAs tend to be localised, and flow lengths between recharge and discharge zones are typically on the scale of a few hundred meters only. The conceptual model of PPAs involves groundwater flow along three primary pathways:

- Deep fractures in the bedrock (deep groundwater flow);

- Shallow fractures near the top of the bedrock (shallow groundwater flow near the bedrock surface);

- Shallow, interconnected fractures in the "transition zone", which is a weathered and often "rubbly" broken zone at the interface between bedrock and overlying subsoils.

The deeper groundwater system has a finite ability to accept recharge on account of low storage and transmissivity. Hence, recharge that is rejected from the deeper system accumulates and flows through the shallow fractured zones under prevailing gradients. In this context, the transition zone may play an important role in transmitting water to nearby receptors. A detailed study of soil and shallow groundwater flow in an upland catchment in Wales (Haria and Shand, 2004 and 2006) demonstrated that a lateral "rapid flow horizon" transported water down slope as "interflow" (at the soil–bedrock interface) whereby upper soil horizons remained largely unsaturated except along a narrow band along the stream (discharge area).

The EPA is presently undertaking a national drilling and testing programme to characterise the hydrogeology of poorly productive aquifers in greater detail. A dedicated network of monitoring wells is being established in several catchments around the country. This involves constructing wells to different depths to monitor the different zones and pathways described above.

The particular significance of PPAs in urban areas is the awareness that shallow pathways may be more important than deeper groundwater pathways in terms of the fate and transport of pollutants.

2.5 Urban Groundwater Receptors

Receptors of urban groundwater pollution are of three basic types:

- Abstraction wells within the urban footprint;

- Surface water to which groundwater discharges (provided groundwater and surface waters are hydraulically connected);

- Wetland areas to which groundwater discharges (provided groundwater and wetlands are hydraulically connected).

Figure 9 shows the locations of abstraction wells that have been identified in urban footprints through the national FC study on groundwater abstractions pressures (CDM, 2009). From a list of more than 160 public, private and industrial wells identified, 55 have been confirmed, but the list is not exhaustive. In recent years, there has been an explosion in drilling around the country, and it is expected that the number of urban abstraction wells is considerably greater.

Groundwater in urban areas is presently not an important source of public water supply. There are only three identified drinking water supply wells within the urban footprints under study; Drybridge PWS (250 m^3/day) near Drogheda; Ballymakenny GWS (1,100 m^3/day) near Drogheda; and Portlaoise-Meelick PWS (773 m^3/day) near Portlaoise.

Groundwater abstractions in urban areas are used for a variety of other purposes, notably industrial processing and commercial activities (e.g., food and drinks industry). The full extent of abstractions from these sectors is not well understood, and warrants a separate survey.

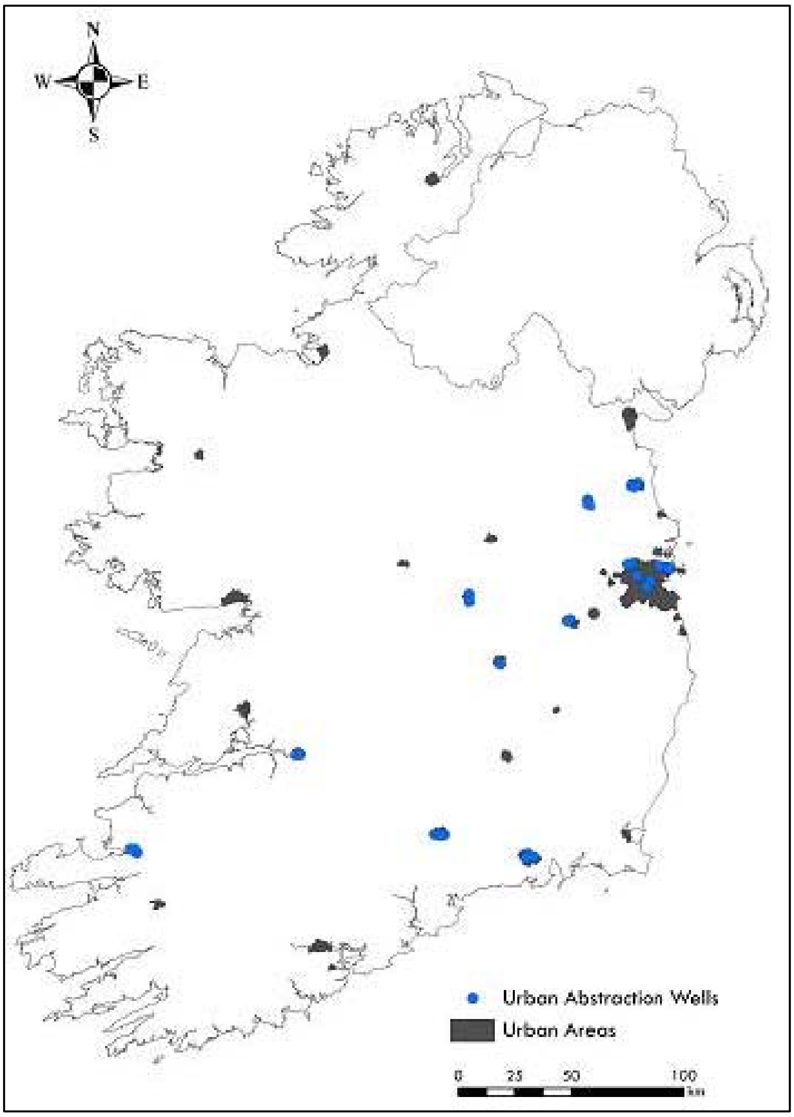

Figure 9: Verified Abstraction Wells in Urban Areas

Polluted groundwater that is abstracted from wells can be treated prior to use. Due to the difficulty and expense associated with treatment of water supplies, increased emphasis should be placed on protection of urban aquifers, especially where they are used for drinking water or the food and drinks industry.

Most Irish towns are associated with rivers, estuaries or coastal waters. Pollutants that discharge from groundwater to surface water bodies will be significantly diluted as a result of mixing. The larger towns are situated on estuaries or bays which are tidal, which increases the mixing potential further. While there are documented cases of polluted groundwater from contaminated land sites affecting river water quality (e.g., Avoca, Co. Wicklow), there are no specific studies available in Ireland that document urban diffuse pressure impacts on surface water quality. In England, Ellis and Rivett (2007) describe urban groundwater pollution and impacts to the River Tame in Birmingham from industrial sources.

Figure 10 shows potential ecological receptors that have been identified. Many of these include Special Areas of Conservation (SACs) and groundwater dependent terrestrial ecosystems (GWDTEs) that have been defined by the National Parks and Wildlife Service (NPWS).

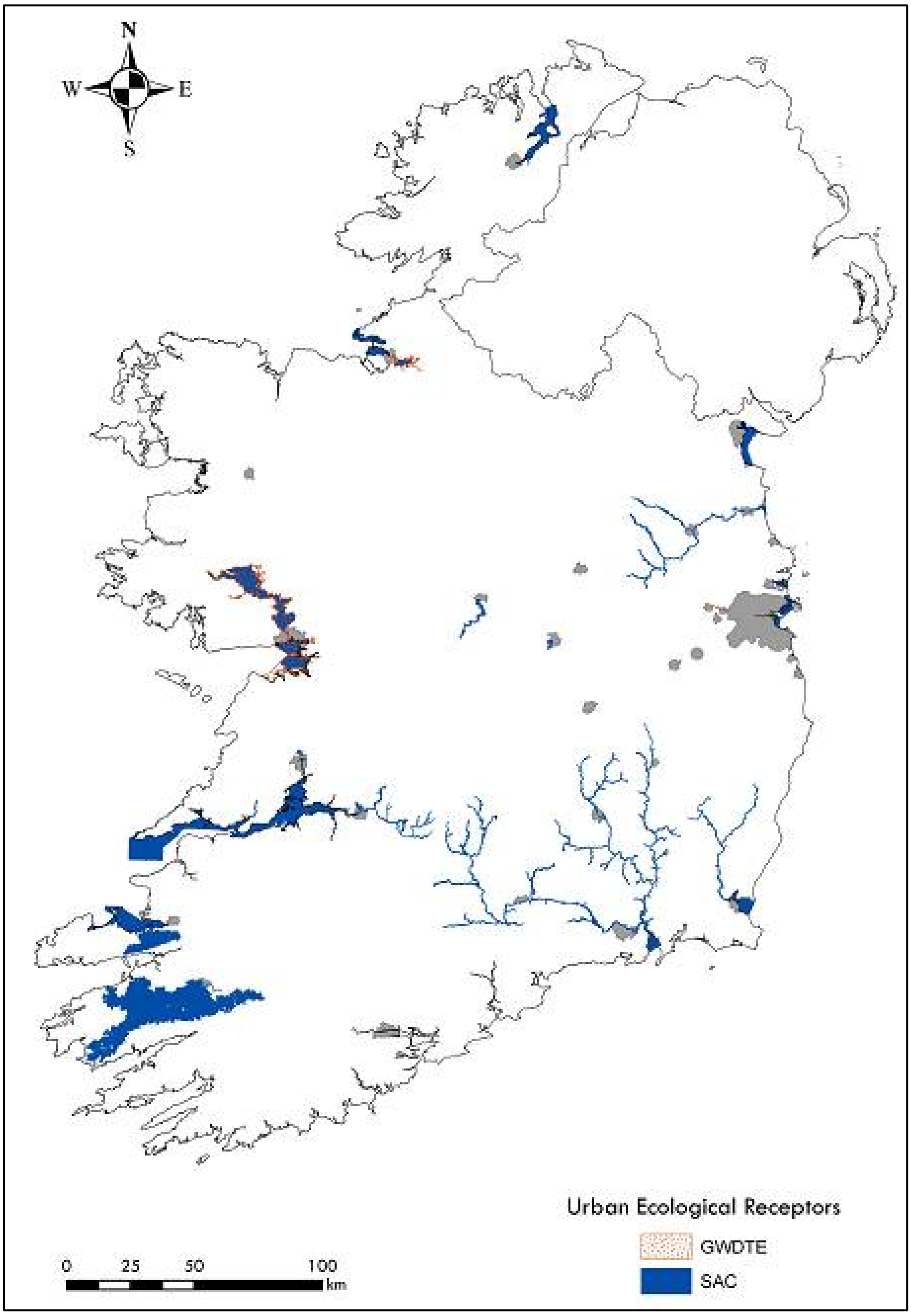

Figure 10: Potential Ecological Receptors in Urban Areas

Although 19 of the 33 urban areas included in this study have receiving waters that are classified as Special Areas of Conservation (SAC), only 4 urban areas are directly associated with GWDTEs:

- Maynooth and Leixlip –Ryewater Valley/ Carton SAC;
- Galway – Galway Bay Complex SAC and Lough Corrib SAC;

- Sligo – Lough Gill SAC.

Recent work by the NPWS (2008) has identified the Ryewater Valley SAC as being at risk of not meeting WFD status objectives by 2015 due to changing hydrological conditions associated with urbanisation. The environmental supporting conditions of, and impacts on, the Ryewater GWDTE have yet to be documented through study and monitoring. The EPA installed monitoring wells within the Carton estate in 2008, and while these relate to a separate research programme, the data generated will be helpful to the NPWS in their assessment of potential future urban impacts on the Ryewater Valley SAC.

The boundaries of the GWDTEs surrounding Lough Corrib and Lough Gill have not yet been delineated in detail and so the wetland areas may not actually fall within the urban footprint.

There are no known impacts, and no available information from literature on specific groundwater impacts to urban ecosystems in Ireland.

2.6 Urban Groundwater Balance

The urban groundwater balance contains numerous variables which relate to natural hydrological processes as well as their interactions with infrastructure and engineered structures.

The groundwater balance has two primary components: recharge and discharge.

2.6.1 Recharge

There are three principal sources of recharge:

- Direct or indirect infiltration from rainfall and runoff;
- Direct infiltration from leaking water mains;
- Direct infiltration from leaking sewer networks and return flows from septic systems (in unsewered areas).

Excess irrigation water would also provide a source of recharge, but there are no significant irrigation areas within Irish towns or cities. The outlying areas of North Dublin would be an exception but the irrigated areas largely fall outside the urban footprint defined for this FC study.

2.6.1.1 Infiltration from Rainfall and Runoff

Natural recharge in urban areas would mostly be confined to open, unpaved spaces as well as natural soakaways and engineered infiltration structures (e.g., detention ponds). Actual recharge rates would be influenced by site-specific soil and subsoil conditions, and there is no single rule that can be applied to estimate natural recharge accurately without carrying out detailed assessments involving field work and monitoring.

No specific urban recharge studies have been carried out in Ireland. Case studies in the literature show a wide range of estimated recharge values (<10-30% of rainfall) for both small and large cities, reflecting the site-specific nature of recharge processes and urban fabrics. In the UK, detailed studies in cities such as Nottingham and Birmingham indicate natural recharge on the order of 10-25% of effective rainfall (Yang et al., 1999; Lerner, 2002). The nature of subsoils will have a determining influence on recharge rates.

Table 6 presents estimated average long-term recharge rates from rainfall in the 33 towns included in this study, and are based on the national recharge map shown in **Figure 11**. As part of a national FC study of groundwater abstraction pressures (CDM, 2009), a national groundwater recharge map was collated with inputs from RBD projects and subsequently updated to depict the distribution of the estimated long-term (30-year) annual median groundwater recharge across Ireland. The recharge map was derived by applying a range of recharge coefficients for different combinations of physical scenarios, using the methodology originally proposed by the UK Technical Advisory Group (UKTAG) for abstraction risk assessment purposes and which was adopted by the national groundwater working group (GWG, 2005).

Table 6: Estimated Annual Recharge from Rainfall

Urban Area	Primary Aquifer Type	Estimated Average Long-term Recharge (mm/yr)	Urban Area	Primary Aquifer Type	Estimated Average Long-term Recharge (mm/yr)
Athlone	Ll	170	Leixlip	Ll	110
Balbriggan	Lm	60	Letterkenny	Pl	150
Bray	Pl	100	Limerick	Lm	150
Carlow	Rkd and S&G	150	Malahide	Ll	75
Carrigaline	Ll	210	Maynooth	Ll	120
Castlebar	Rkc	300	Mullingar	Ll	150
Celbridge	Ll	150	Naas	Ll and S&G	150
Clonmel	Rkd	150	Navan	Lm	200
Cork	Rkd	170	Newbridge	Rkd & S&G	250
Drogheda	Rkd	100	Portlaoise	Rkd	200
Dublin	Ll	80	Sligo	Rkc	200
Dundalk	Pl	130	Swords	Ll	70
Ennis	Rkc	430	Tralee	Rkd	220
Galway	Pl and Rkc	100 - 270	Tullamore	Rkd	150
Greystones	Pl	100	Waterford	Rf	250
Kilkenny	Rkd and S&G	230	Wexford	Pl	120
Killarney	Rkd	215			

The physical scenarios and associated recharge coefficients are defined by three primary pathway factors: soil type, drainage characteristics, and groundwater vulnerability. For urban areas, the national GWG considered an average recharge coefficient of 20% for Irish towns as reasonable (i.e., 20% of effective rainfall infiltrates to groundwater). This number could be higher or lower at any given location within a town depending on the spatial distribution of soil and subsoil characteristics.

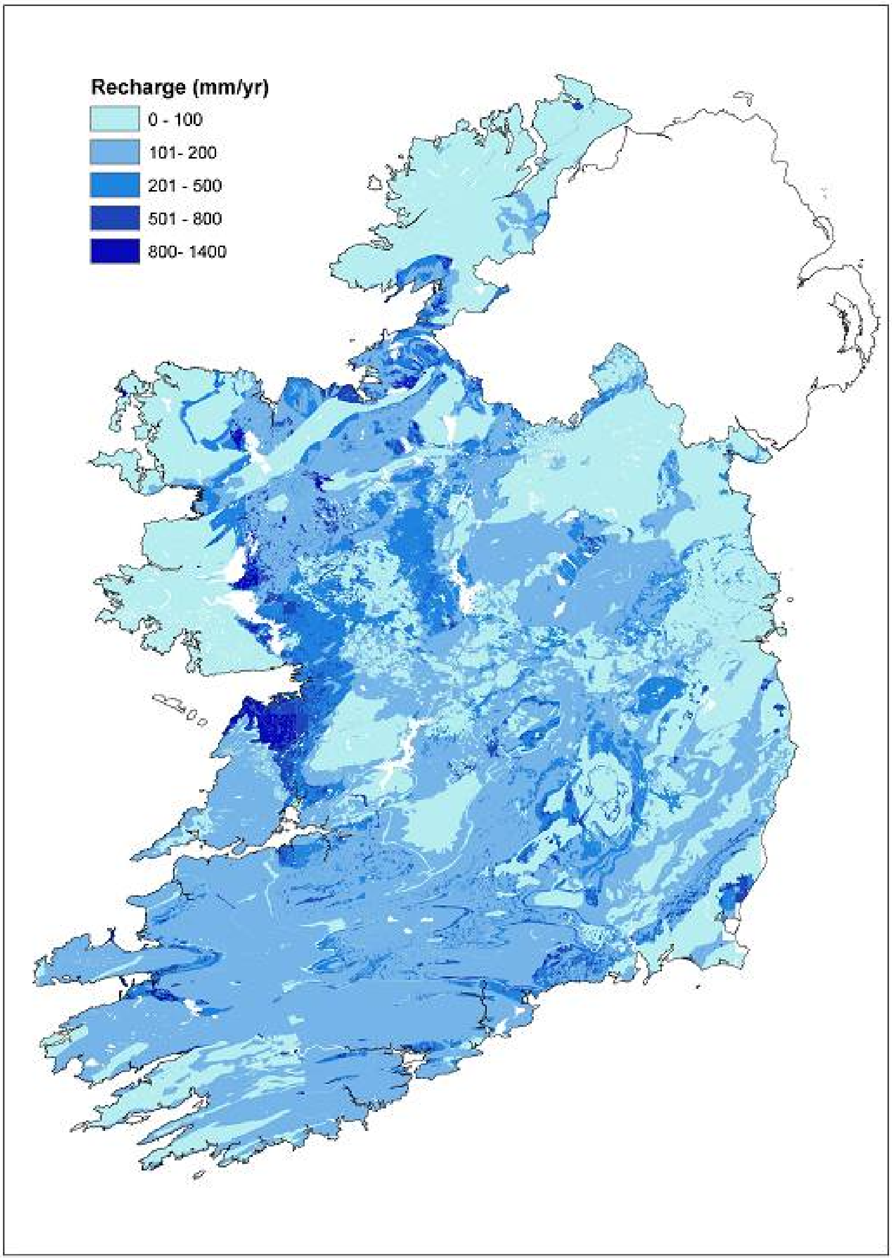

Figure 11: National Groundwater Recharge Map

Estimated (natural) recharge rates range from <100 mm/yr in the eastern towns to >300 mm/yr in western towns. In the east, most towns are partly or wholly underlain by glacial till and poorly productive rocks. In the west, several larger towns are located on vulnerable and highly transmissive karstic limestones.

Maximum groundwater recharge capacities in towns that are situated on PPAs are limited by the low storage and transmissivities of these rock types. Work carried out by the national Groundwater Working Group (GWG, 2005) suggests that recharge to PPAs is limited by recharge acceptance considerations to about 100-200 mm/yr, depending on aquifer classification (see Table 4). Rejected recharge enhances shallow movement of water along near-surface pathways, including overland flow.

Urban runoff volumes were developed for each of the 33 urban areas in the accompanying assessment of urban pressures on surface waters (CDM, 2008a). Respective volumes by land use are reproduced in **Table 7**. Only a small fraction of the total runoff volume will infiltrate to groundwater, and the infiltration rates and volumes will be higher where permeable subsoils are present and at locations where runoff collects, either naturally or by design. Unless urban-specific water balance studies are carried out, there is no simple means of estimating what percentage of runoff volumes actually infiltrates in any given town.

With the recent trend of incorporating Sustainable Urban Drainage Systems (SuDS) for new developments, recharge from runoff can be cumulatively enhanced. SuDS are now adopted as policy by most local authorities, and SuDS options are reviewed by planner and drainage engineers during the planning permission process. There is however, no registration or database of existing SuDS in Ireland. Such a database would be helpful in future urban water balance studies. The types of information that should be captured are: location, type, volume captured, and runoff water quality.

2.6.1.2 Leakage from Water Mains

Leakage from water mains is a significant contributor to urban groundwater recharge in Ireland. Depending on the source of information, leakage rates up to 40% have been reported. In Greater Dublin, which has an ageing water distribution network in city centre, distribution leakage losses have recently been estimated to be approximately 28% of the total flow through the distribution system (Leahy, 2007), totalling almost 140,000 m^3/day. Dublin's water distribution network totals a length of approximately 8,000 km, of which 800 km is more than 80 years old. The older parts of the network, in the city centre, are suspected to account for the bulk of leakage. Regional authorities in Greater Dublin are actively undertaking leak detection and repair, reinforced by a water main rehabilitation programme managed by DCC.

Over the approximately 431 km^2 urban footprint of Greater Dublin, a total leakage of 140,000 m^3/day would equate to 119 mm/yr of recharge assuming that all of the leakage infiltrates to the underlying aquifers. In this case, leakage would exceed the estimate of 80 mm/yr of natural recharge from rainfall for the Dublin limestone ("Calp") aquifer (from Table 6).

2.6.1.3 Exfiltration from Leaking Sewers

Specific studies of leaking sewers have not been carried out in Ireland. Exfiltration, while acknowledged, was not identified as a particular item of concern during the GDSDS or the National Urban Wastewater Study (NUWWS) (DEHLG, 2005). As stated in the GDSDS, the principal difficulty in identifying exfiltration is the fact that they tend to be small compared to the much larger infiltration flows. The GDSDS cites a situation where exfiltration was suspected but could not be identified due to limited flow monitor tolerances and the wide spread of flow monitoring locations in the particular sewer network.

Table 7: Mean Annual Urban Runoff Volumes from Different Land Uses (m^3/yr)

Urban Areas	Town Centre	Commercial	Residential	Heavy Industrial	Light Industrial	Mixed use	Open space – Managed	Open space – Unmanaged	Urban Roads
Athlone	106,957	125,960	1,512,784	0	659,100	393,161	392,337	0	885,190
Balbriggan	214,645	0	472,458	0	349,486	14,400	490,803	2,777	398,135
Bray	166,143	0	1,485,078	0	122,950	308,915	83,547	106,053	161,256
Carlow	331,886	0	870,826	0	274,257	291,626	77,286	0	420,095
Carrigaline	43,718	0	1,292,900	0	90,043	59,808	34,364	0	263,015
Castlebar	357,466	34,050	1,878,438	0	155,513	327,573	252,383	0	667,208
Celbridge	0	51,627	799,442	0	36,748	108,439	341,333	0	139,243
Clonmel	0	378,921	2,045,044	238,518	21	552,251	465,638	0	630,984
Cork	5,676	677,070	8,587,586	359,068	473,929	831,195	939,852	152,871	2,103,547
Drogheda	210,755	0	1,805,195	0	926,574	528,140	188,783	0	762,000
Dublin	4,236,756	0	72,098,467	1,894,398	26,019,244	16,409,221	24,503,205	16,778,217	54,851,098
Dundalk	409,188	38,520	4,174,338	44,465	429,096	4,469,745	1,245,262	230,963	2,829,208
Ennis	595,023	440,001	4,956,360	0	213,952	377,793	971,928	0	1,638,944
Galway	569,825	2,166,593	12,055,069	0	2,518,317	3,505,165	7,032,035	0	5,162,820
Greystones	256,260	0	1,533,978	0	120,166	61,442	110,207	289,421	380,356
Kilkenny	0	280,207	1,839,067	0	356,909	388,442	867,787	0	810,657
Killarney	42,269	54,230	2,051,530	0	91,968	144,737	49,003	1,115,427	59,545
Letterkenny	324,235	282,618	3,490,261	0	1,566,312	1,093,929	278,015	477,552	724,905
Leixlip	52,271	0	596,490	0	197,650	128,144	393,227	0	195,875
Limerick	0	361,484	5,311,210	0	61,262	820,203	853,144	0	1,822,570
Malahide	86,555	0	1,068,784	0	0	13,951	53,168	6,548	333,182
Maynooth	185,315	0	567,941	0	9,260	308,187	413,288	0	204,885
Mullingar	235,804	166,641	1,519,552	0	158,552	429,157	68,129	239,577	814,893
Naas	205,492	48,062	1,374,756	0	227,793	175,411	1,147,954	0	235,521
Navan	285,989	0	1,512,111	152,305	27,789	334,947	157,118	96,880	877,087
Newbridge	249,691	0	984,433	0	152,466	97,523	573,832	0	328,510
Portlaoise	293,958	89,038	1,703,356	0	447,648	311,208	173,989	0	391,199
Sligo	771,035	633,331	4,832,497	192,769	825,640	2,021,367	1,346,174	0	3,551,066
Swords	307,485	0	1,237,086	0	829,327	372,449	135,012	2,357	882,511
Tralee	0	66,347	2,782,779	0	539,874	636,026	441,797	0	584,861
Tullamore	0	348,569	1,533718	470,599	20,547	309,454	43,458	45,283	561,274
Waterford	239,023	0	3,561,150	0	1,783,553	1,214,996	2,577,257	634,492	2,302,066
Wexford	530,796	0	1,825,518	0	286,216	447,136	663,248	0	442,679

Source: CDM, 2008b

Sewer leaks will occur if the sewer invert is above the groundwater table for parts of, or the whole of, the year, or if the sewer line below the groundwater table is pressurised. A review of local authority records suggests it would be difficult to pin-point such areas with any degree of confidence and this type of information is generally not recorded in asset records or existing GIS tools (e.g., SUS25). However, the GDSDS reporting concludes that "we can be confident that exfiltration is occurring in tandem with infiltration" (GDSDS, 2005).

While there are no specific reports of sewer leak rates in Irish towns, literature from the UK and Germany suggests that exfiltration is small, and that actual rates will depend strongly on factors that relate to both the physical integrity of the sewer system and the physical characteristics of the groundwater system. Ellis (2004), Yang et al. (1999) and Bishop et al. (1998) describe exfiltration rates of 2-5% of sewer flows in UK cities. Cronin et al. (2005) suggests slightly higher numbers for a suburb of Doncaster, where exfiltration is reported to be in the range of 20-45mm/yr, corresponding to a total leakage of 7-15% of the annual sewage throughput. In the Greater London region, estimates by Bishop et al. (1998) suggest a 5% loss, equivalent to a recharge rate of some 20 - 25 mm/year.

The estimated total DWF of the Ringsend sewer catchment, as reported in the GDSDS, was 364,000 m^3/d in 2005. A 5% exfiltration coefficient would therefore equate to approximately 18,000 m^3/day or 15 mm/yr averaged over the roughly 431 km^2 urban footprint area. While shallow groundwater quality in the Dublin city centre (in the sand and gravel aquifer) shows signs of impact from sewage (see Section 4), there is no information to verify actual exfiltration percentages in any town in Ireland.

Blackwood et al. (2005) summarise exfiltration measurements from a variety of international sources, ranging from 0.01 to 4.0 l/s/km. Wolf et al. (2005) conclude that leakage rates of more than 1 l/s/km seem to be unrealistically high and of limited transferability. It is reported that a leakage rate of 2 l/s/km in the city of Rastatt would result in groundwater recharge from sewers of 794 mm/yr, which surpasses the natural recharge rate from rainfall by a factor of seven, which is not supported by hydraulic and hydrochemical observations.

While the spatial distribution of exfiltration, or areas that would be susceptible to exfiltration, are not well defined or understood in Irish towns and cities, it is not expected to be a problem where groundwater is very shallow (frequently less than two metres below ground surface). This is likely the case for most Irish towns. To understand exfiltration better, relevant data need to be collated such as sewer line elevations, sewer leaks and integrity, depth to groundwater, and subsoil permeability.

Sewer integrity can be assessed through flow monitoring and camera surveys, but is costly. Limited information on sewer integrity is provided in the NUWWS as well as more recent documents associated with main drainage schemes (e.g., Cork). Stated objectives of the NUWWS were to assess networks deficiencies, record investigation needs, as well as develop guidelines and criteria for performance monitoring and investment prioritisation. The work involved a cursory inventory and network integrity audit of sewage systems in 170 wastewater catchments around the country (excluding the area covered by the GDSDS).

The following NUWWS reporting is of particular relevance to exfiltration (Aikman and Kennedy, 2005):

- 71 of 170 (41%) sewer networks reported structural sewer failures;
- 6% of gravity sewers were reported to be Grade 4 and 5;
- 1% of rising mains were reported to be Grade 4 and 5;
- 7% of combined sewer overflows (CSOs) were reported to be Grade 4 and 5;
- 8% of other ancillaries were reported to be Grade 4 and 5.

Asset Grade 4 implies assets are likely to collapse in the near future whereas Grade 5 implies assets have collapsed or are substantially derelict.

While this information suggests that sewer integrity is a real issue, it cannot be implied that exfiltration takes place on an equivalent scale. The NUWWS information is cursory, and information was extrapolated across sewered catchments with low levels of confidence assigned.

Research work in Germany provides important information about the processes of exfiltration. Wolf et al. (2005) described results of a test site in the city of Rastatt which was constructed beneath a sewer line in which a leak was created. The test site was subject to natural variations of water level and sewage composition induced by rain events. The daily summation of the outflow of the collecting tank underneath one small leak showed considerable differences during base flow conditions. Maximum exfiltration rates of 230 l/d were recorded immediately after cutting a ($30cm^2$) slit into a DN500 sewer. Exfiltration rates subsequently decreased with time and the system "equilibrated" after about 6 months. Mean exfiltration rates were estimated at 0.05 l/hr during dry weather flow and 0.21 l/hr following storm events.

Dohmann (1999) reported no correlation between leak size and exfiltration rates from laboratory experiments, and concluded that site-specific factors will determine the nature and extent of leakage from any given sewer system. Wolf et al. (2005) note that sewer leaks can be expected to decrease with time due to sealing effects whereby a lower-permeability clogging layer is built up inside sewer pipes and in the leak area, as well as clogging formed in the sediments of the material outside and below the sewer leak. Ellis et al. (2002) also found a low likelihood of exfiltration in sewers subject to sedimentation, as well as suggesting that sewer leakage may be random in nature and dependent on local pipe, hydraulic and groundwater circumstances.

2.6.1.4 Septic Tanks

Septic tanks are still partly in use within most of the 33 towns studied, and the 2006 census data provides statistics of the number of households on septic systems on a district-electoral division (DED) basis.

As a check on the influence that septic tanks may have on urban recharge, estimates of septic return flows to groundwater were made for 6 towns and cities, as shown in **Table 8**.

Table 8: Estimated Volumes of Septage and Associated Recharge in 6 Towns

Urban Area	No. HHs with Septic Tanks	Average No. People per HH	Extra-polated Population	Total Volume (Ml/d)[1]	Total Volume of Septage [2] (m^3/d)	Urban Footprint Area (Km^2)	Depth of Septage over Urban Footprint (mm/yr)
Dublin	2228	2.7	6016	0.902	767.0	431.08	0.65
Galway	799	2.7	2157	0.324	275.1	50.54	1.99
Cork	277	2.6	720	0.108	91.8	39.47	0.85
Waterford	243	2.6	632	0.095	80.6	41.65	0.71
Naas	119	3	357	0.054	45.5	18.30	0.91
Limerick	128	2.6	333	0.050	42.4	20.26	0.76

HH = household;
[1] - assumes consumption of 150 litres per capita per day;
[2] - wastewater generated = 85% of water consumption

The total volumes of septage generated in the larger cities would range from 42m^3/d in Limerick to 766 m^3/d in Dublin, whereas averaged over the urban footprints, the estimated recharge would range from 0.65 mm/yr in Dublin to 2.00 mm/yr in Galway. On this basis, it is suggested that septic tank returns are not important components of urban recharge. However, they may have an impact on local groundwater quality.

2.6.2 Discharge

There are three principal types of groundwater discharge:

- Groundwater abstractions;
- Sewer infiltration;
- Natural flow and discharge to rivers, estuaries, and groundwater-dependent terrestrial ecosystems (GWDTEs).

2.6.2.1 Groundwater Abstractions

As described in Section 2.5, the extent of groundwater abstraction in urban settings is likely underestimated, and an expanded survey of commercial/industrial wells across all urban areas is recommended (see Section 5). An improved inventory of existing abstraction wells is important for several reasons:

- There may be more consumptive users of groundwater than assumed;

- Such wells could be included in future groundwater quality monitoring programmes;
- Pumping patterns can spread groundwater pollution. Head differentials between shallow and deeper aquifer units induced by pumping can also draw polluted groundwater into deeper aquifer units.

Understanding flow patterns and gradients is therefore important to the assessment of pollution risk to downstream receptors.

2.6.2.2 Sewer Infiltration

In the same way that water mains leakages add recharge to groundwater systems, combined-foul sewer pipelines remove groundwater from the same systems. Inflow/infiltration (I/I) into sewer networks is a recognised operational problem in most towns and cities across Ireland. The term “inflow” is generally used for water entering the sewer system directly, whereas the term “infiltration” is used for water entering the sewer system from groundwater. The maximum flow to treatment works is often dominated by inflow due to storm events, whereas infiltration represents a more constant flux of water (baseflow) into the sewer network.

The GDSDS (2005) estimated that the total infiltration within the Ringsend sewer catchment is nearly 2,100 litres per second (l/s), or 173,000 m^3/day. This value is remarkably similar to the total estimated water mains leakage rate in Dublin of 140,000 m^3/day (see Section 2.6.1.2), and would equate to an infiltration depth of water of 146 mm/yr averaged over Dublin’s’ urban footprint area.

The distributions of leaks and infiltration volumes will vary significantly in space in time. Unfortunately, there are no dedicated water level monitoring networks in Irish urban areas that can be used to verify the net impacts of urban groundwater balance components.

2.6.2.3 Natural Groundwater Discharges

Natural groundwater discharge points in Irish towns and cities are rivers, estuaries, and coastlines. Only four towns or cities are directly associated with GWDTEs; Maynooth, Leixlip, Galway and Sligo.

Groundwater flow and discharge rates from urban areas are relevant because polluted groundwater adds pollutant mass to groundwater receptors. Actual discharge volumes or rates will vary depending on hydrogeological characteristics that are urban-specific.

EPA’s recent work on the chemical status classification of rivers and transitional waters (EPA, 2008a) does not identify groundwater as a significant contributor to poor status cases in urban areas. Rather, morphological pressures and wastewater discharges are highlighted as the primary causes of poor status designations within Irish towns and cities.

Similarly, none of the GWDTEs that are located within the 33 urban areas are classified as being of poor ecological status on the basis of urban pressures (NPWS, 2008).

2.6.3 Groundwater Balance Uncertainties

To be quantified with any degree of certainty, the components of the urban groundwater balance require detailed study, measurement and monitoring. Some components are more difficult to quantify than others. Studies such as the GDSDS and the NUWWS have contributed greatly in defining the broader characteristics of water and wastewater components across Ireland, but the details that are typically needed to quantify urban-specific groundwater balances are generally not available through existing local authority records or geographic information systems. Local authority service managers and technicians add value by having urban-specific knowledge, but experiences from this project suggests that this knowledge may not always be recorded.

Table 9 summarises information on the groundwater balance components of Dublin, and highlights what is known or has been estimated from available information. As such, Table 9 is not a water balance, but represents a first approximation of basic component numbers. Water mains leakage (Leahy, 2007) and sewer infiltration rates (GDSDS, 2005) are the largest individual components of the groundwater balance of the Dublin urban footprint.

Table 9: Summary of Information on Groundwater Balance Components in Dublin

	Existing studies?	Depth (mm/yr)	Rate (m^3/yr)	Information Source
Groundwater recharge:				
Rainfall	No	80	34,482,867	CDM, 2009 - estimated using an average recharge coefficient of 0.2 for urban areas (i.e., 20% of effective rainfall recharges the Dublin urban GWB).
Leaking water mains	Yes	119	51,100,000	Leahy, 2007 (approx. 140,000 m^3/d)
Sewer exfiltration	No	15[2]	6,570,000	Assumes that 5% of greater Dublin sewer dry weather flow (GDSDS, 2005) exfiltrates
Septic systems	No	0.65	279,955	Section 2.6.1.4 of this report
Groundwater discharge:				
Abstraction	No	0.01	365,000	Total abstraction rates are not known but estimated to be <10,000 m^3/d
Sewer infiltration	Yes	147	63,145,000	GDSDS, 2005 (dry weather flow at Ringsend WWTP = 173,000 m^3/d)
"Theoretical" groundwater discharge from Calp aquifer	No	13	5,529,750	Assume K=0.1 m/d derived from regional transmissivity data (RPS/EPA, 2008, QUB, 2006; Rooney, 2002); Hydraulic gradient = 0.01 (Rooney, 2002; GSI, 2004); Assume uniform discharge over 30 m depth, over 470 km of total stream length and 35 km of coastline within the urban footprint.
"Theoretical" groundwater discharge from S&G aquifer in city centre	No	108	6,278,000	Assume K=10 m/d (Rooney, 2002; QUB, 2006); Hydraulic gradient = 0.01 (GSI, 2004); Assume uniform discharge over 10 m depth, over 17.2 km of coastline - north and south of the Liffey and Port/Ringsend area.
Canal leakage	No	no info	no info	The Grand and Royal Canals may serve both as hydraulic sinks and sources to groundwater, depending on location. No estimates exist on literature. It is assumed that both canals primarily serve as sinks, i.e., shallow groundwater flows into canals.

Compared to other cities or towns in Ireland, Dublin is "data-rich" in relation to its infrastructure but, like all other cities and towns, is "data-poor" in relation to monitoring of groundwater levels, flow, and quality. Hence, trends and changes in the net effects of groundwater inflows and outflows over time cannot be explored. While groundwater monitoring wells do exist, these are associated with specific facilities and do not cover broader environmental pressures. Existing monitoring networks are described further in Section 4 in relation to groundwater quality.

Based on a review of available information, the water balance components that are most difficult to quantify are:

- Sewer exfiltration volumes;
- Abstraction rates from private wells (industrial/commercial uses);
- Natural groundwater discharges.

Sewer exfiltration has not been empirically quantified anywhere in Ireland, and the estimate for Greater Dublin assumes that 5% of the dry weather flow in the Ringsend sewer catchment leaks (see Section 2.6.1.2).

Total abstractions are not known, because the current national register of abstractions contains significant gaps in relation to industrial and commercial abstractions.

Groundwater discharges are estimated based on simple hydrogeological principles, using reported and averaged data on hydraulic properties and gradients from the Dublin GWB, as well as the sand and gravel deposits that underlie the city centre along the Liffey. As such, the computed discharges represent approximations. The estimated discharge from the "Calp" limestone that makes up the Dublin GWB is 5.5 Mcm/yr, and represents a "theoretical" discharge along the entire coastline and the total stream lengths within the footprint (it is assumed that all the streams within the footprint are gaining streams).

In comparison, the reported sum of the Q_{95} percentile flows in streams within the Dublin urban footprint is approximately 17 Mcm/yr, including the station at Waldron's Bridge on the Dodder, which alone has a reported Q_{95} of 11 Mcm/yr. The Q_{95} value is relevant because it represents the flow in the streams that is exceeded 95% of the time, and is sometimes used as a surrogate estimate for the contribution of groundwater discharges to streams (referred to as "baseflow").

There could be any number of explanations for the apparent discrepancy between the calculated groundwater discharges and reported stream flows:

- Calculations of discharges are sensitive to all of the input variables that are used. For example, if the hydraulic gradient was doubled, from 0.01 to 0.02, the estimated discharge would also double, from 5.5 Mcm/yr to 11 Mcm/yr.

- Actual pathways of groundwater flow in poorly productive rocks (such as the Calp limestone) are complex, and may not be well represented by the averages used in Table 9.

- The Q_{95} flows in Dublin may also represent seepages from glacial tills into the streams (not included in the discharge calculations).

- The rating curves of gauging stations are reportedly of variable quality.

- Flow records may also be affected by urban influences such as unspecified or unknown (constant) discharges.

To improve on groundwater balances in any urban area, including Dublin, a much greater level of detail is required in terms of study and monitoring. It can be argued that there may not be a pressing urgency about this since urban groundwater is generally not used for public water supply (although it could be more important than presently recorded for industry/commerce), and is not regarded to be a major contributor of pollutants to urban streams and estuaries (compared to other known sources).

2.7 Fate and Transport of Pollutants

The fate and transport of pollutants in urban groundwater requires knowledge of the chemicals that are present, their chemical properties, and physical-chemical transport processes. The major processes that determine the presence of chemicals in groundwater are well described in literature. Mass flux from soils to groundwater, as well as migration in groundwater, involve the following variables:

- Chemical properties - water solubility, adsorption/desorption (tendency to adhere to soil, subsoil or aquifer materials), and persistence (degradation);

- Soil, subsoil and aquifer properties – type, texture, organic matter content, ion exchange capacity, hydraulic properties, moisture content, temperature, pH and oxygen status;

- Climate - rainfall (rate, duration, intensity, timing), daylight and sunshine hours (photolysis);

- Mixing (dilution);

- Hydraulic stresses (flow patterns and gradients).

As a result, fate and transport is a highly location-specific science. The separate POMs study on groundwater risk from pesticides (CDM, 2008b) demonstrated that the principal controls on leaching of chemicals to groundwater are: the chemical properties of pollutants, groundwater vulnerability and recharge (infiltration rates). In particular, the mass flux of soluble chemicals through soils is directly linked to infiltration rates (all other factors being constant).

Chemicals with higher persistence and weaker sorption properties are more readily leached, and therefore more likely to be detected in groundwater. Without water to move chemicals through soils, chemicals are more likely to remain in soils.

Detections of chemicals in groundwater are also considered to be more likely where groundwater vulnerability is highest, i.e., where subsoils materials are thin or absent, and where permeable soils and subsoils are present. Chemical contamination is also more likely in shallow groundwater than in deep groundwater. Such generalised rules may not apply where preferential pathways exist or where vertical head gradients are significant.

The types of chemicals detected in groundwater reflect usage and disposal practices, their chemical properties, as well as the physical-chemical characteristics of the subsurface environment. Different chemicals behave differently in different soil and aquifer media, and some are of greater concern than others. Combined, the processes of adsorption and degradation in soils and groundwater determine the subsurface mobility of chemicals (CDM, 2008b). Adsorption indicates how strongly a chemical binds to the soil while degradation measures how long the chemical stays in its original form. A chemical that does not adsorb to soil readily and has a slow degradation rate will have a higher potential for leaching to groundwater, and will persist longer in the groundwater environment.

Contaminants such as polycyclic aromatic hydrocarbons (PAHs), phosphates, and PCBs have relatively low solubilities in water and tend to adsorb to particulates in the soil matrix. As a result, they also tend to be attenuated in soil. BTEX compounds and certain solvents are examples of compounds that are more mobile in the subsurface environment.

Degradation behaviour is important to take into consideration since it may point to sources and transport processes (including travel times) that would otherwise result in false interpretations of pollution patterns. For example, degradation products of commonly used solvents used in dry cleaning, metal cleaning and degreasing operations, such as tetrachloroethene (PCE) and trichloroethene (TCE) include cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride.

The degree to which a chemical will adsorb and degrade is controlled by the type and texture of soils/subsoils, the content of organic carbon, and the state of oxygenation (aerobic vs. anaerobic conditions). These influence the ease with which water can pass and the ability to bind chemicals to the soil/subsoil matrix. Well drained and mineral-derived soils tend to allow vertical migration of leachates more freely, whereas poorly drained soils tend to impede leachate migration.

3. Risk Identification and Ranking

The relative risk to groundwater of pollution in the 33 urban areas was screened and ranked in an effort to guide future monitoring efforts, as well as to identify where Programmes of Measures may be needed as part of future RBMP implementation.

Combined with the review of groundwater quality (see Section 4), the risk evaluation was aimed at assisting the EPA in their classification of the qualitative (chemical) status of urban GWBs, as per the requirements of the WFD. The following sections describe the methodology used, the major inputs, and results. They also highlight the most significant data gaps associated with the state of knowledge of urban groundwater risk in Ireland.

3.1 Approach and Methodology

The underlying approach follows the source-pathway-receptor (S-P-R) model which underpins the basic implementation of the WFD. S-P-R attributes were researched, screened, mapped and quantified to the extent possible, partly to understand the scale and nature of available information and partly to identify data gaps that may have to be addressed in the future.

The methodology follows a system whereby relative scores and weights are assigned to key S-P-R attributes, and is similar in scope to the methodology used by the EPA to assess environmental risk from unregulated waste disposal sites (EPA, 2007). The S-P-R attributes that were decided on in consultation with the steering group include:

Source Attributes:

- Land use - land use information from local authority development plans was reviewed and re-classified into a consistent set of land use groups in each urban area (CDM, 2008a).

- Diffuse sources of pollution – existing sources of information on sewer extents and integrity, transportation networks, and urban runoff were reviewed.

- Point sources of pollution – a register of potential point sources of pollution was generated and updated from the initial risk assessment of 2005, focussing on IPPC and waste licenses, including landfills and contaminated land sites.

- Effective recharge – recharge from rainfall is not a source of pollution, but infiltration controls leaching and mass flux of pollutants from soils to groundwater. It was therefore included as a source factor within the risk framework.

Pathway Attributes:

- Vertical pathways – Teagasc soil and GSI vulnerability mapping, as well as land use classes indicative of impermeable surfaces, were quantified to the extent possible for each town.

- Horizontal pathways - each urban area was ascribed a primary aquifer type.

Receptor Attributes:

- Abstraction wells – Public supply wells were identified and private (commercial/industrial) wells were researched and verified to the extent possible.

- Ecology - ecological receptors within or downgradient of each urban area, including rivers and lakes, as well as GWDTEs identified from NPWS records.

The specific attributes used are summarised in **Table 10** and details on each attribute are included in **Appendix A**. Greatest weights were assigned to the industrial source terms, vertical pathway, and receptor factors. The assignment of scores and weights required professional judgement, as several criteria contain subjective elements because related attributes cannot be sufficiently quantified. Thus, the scoring involved input from specialists in related fields, including hydrogeologists, sanitary engineers, and water resources engineers.

In the ranking scheme, each S-P-R attribute was assigned an index and a weight. The index applies to an individual attribute and is a relative number between urban areas. For example, an urban area with an index of two is more significant in terms of a particular attribute than an urban area with an index of one, and so forth.

The weight applies to S-P-R attribute categories and is a relative number that compares the significance of a particular category. An attribute with a weight of 1 involves a lower degree of pollution risk than 2, and so forth.

The index and the weight were subsequently joined by multiplication:

$$\text{Index x Weight} = \text{Score}$$

In this way, each urban area received a score for each of the S-P-R categories. These were then summed and the urban area with the highest overall score is that considered to involve the highest risk of groundwater pollution and potential impact on receptors.

3.2 Results

Results are summarised in **Table 11** and details of the calculations are provided in **Appendix B**. Dublin is the highest risk-ranked urban area followed by Waterford, Galway and Sligo, Drogheda, and Limerick. Some towns score high on source attributes (e.g., Dublin) while others score high on pathway (e.g., Ennis) or receptor attributes (e.g., Sligo).

Table 10: S-P-R Attributes Used in Risk Ranking

	Attribute	Index	Index Notes	Overall Weight
Source	Industrial - Magnitude	3 = Total area of industry > 20% 2 = Total area of industry > 10% 1 = Total area of industry > 0%	Industrial area as a % of total built-up area; extra index score of 1 assigned to urban areas with heavy industry	3
	Industrial - Variety	5 = Variety > 10 (no.) 3 = Variety > 5 1 = Variety > 1	Based on the number of point sources in built-up area. Urban areas with contaminated land sites have highest index	4
	Amenity Open space	4 = > 6% 3 = > 4% 2 = > 2% 1 = < 2%	Index guided by range of values, and are based on % amenity area over total built-up area	3
	Road	2 = Density > 0.5 km/km^2 1 = Density < 0.5 km/km^2 0 = None	Km primary roads/Km^2 footprint area	2
	Transport (rail, airport)	2 = Railway depot, airport within urban footprint 1 = Railway line or station within urban footprint	Presence/ Absence. If none present, index = 0	1
	Sewer Density	4 = > 15 km/km^2 3 = > 10 km/km^2 2 = > 5 km/km^2 1 = < 5 km/km^2	Density of sewer network in sewer catchment (km/km^2)	2
	Effective rainfall	3 = Effective rainfall >= 800 mm/yr 2 = Effective rainfall >= 500 mm/yr 1 = Effective rainfall < 500 mm/yr	Index based on range	2
Pathway	GW vulnerability	5 = X-E > 25% 4 = H > 50% 3 = X-E >10% or H > 25% or H-L > 50% 2 = Sum of X-E and H > 25% 1 = Other	Index based on % of vulnerability category within footprint area	5
	Flow regime	4 = Karst (=3 if equal karst and PP) 3 = S&G 2 = Fi 1 = PP	Index is based on S&G if S&G overlies bedrock	3
Receptor	Ecological	3 = GWDTE 2 = SAC 1 = Other Water Receptor 0 = None	Presence/ Absence	5
	Groundwater body	2 = DW (public or private) 1 = Industrial facility 0 = None	Presence/ Absence	5

Table 11: Risk Ranked Urban Areas

Urban Area	Score			
	Source	Pathway	Receptor	Overall
Dublin	58	21	25	**104**
Waterford	45	24	25	**94**
Galway	30	34	20	**84**
Sligo	27	27	30	**84**
Drogheda	34	27	20	**81**
Limerick	34	24	20	**78**
Cork	41	31	5	**77**
Tralee	25	27	25	**77**
Ennis	24	37	15	**76**
Clonmel	32	27	15	**74**
Swords	38	18	15	**71**
Portlaoise	26	29	15	**70**
Letterkenny	23	28	15	**66**
Athlone	31	18	15	**64**
Castlebar	31	27	5	**63**
Greystones	20	28	15	**63**
Killarney	20	27	15	**62**
Navan	23	29	10	**62**
Wexford	29	18	15	**62**
Kilkenny	19	26	15	**60**
Leixlip	17	23	20	**60**
Dundalk	25	18	15	**58**
Carlow	20	21	15	**56**
Newbridge	24	26	5	**55**
Tullamore	16	24	15	**55**
Carrigaline	16	31	5	**52**
Balbriggan	27	18	5	**50**
Maynooth	12	18	20	**50**
Mullingar	30	18	0	**48**
Malahide	17	18	10	**45**
Naas	22	18	5	**45**
Bray	21	18	5	**44**
Celbridge	11	23	5	**39**

Risk grouping of urban areas can be inferred from **Table 11**, but this is based on an assessment of present conditions and identified pressures. Actual risk will be influenced by how urban development proceeds and the environmental controls that are put in place. Assuming that pressure factors are managed equally well in all urban areas, future conditions of risk would be more strongly weighted towards pathway and receptor factors. In this case, the highest risk urban areas would be those that are characterised by vulnerable and important aquifers, as well as those that involve important receptors, notably where groundwater is used for human consumption or the environmental supporting conditions of GWDTEs are sensitive to hydrological and chemical changes. **Table 12** summarises a grouping of urban areas that would fit those criteria.

Table 12: Risk Grouping of Urban Areas

Group	Urban Area	Comment
Productive Aquifers, Highest Risk	Galway, Sligo, Ennis	Rk_c aquifer; GWDTE (note – 50% of Galway is underlain by poorly productive rocks)
Productive Aquifers, Moderate Risk	Limerick, Kilkenny, Killarney, Navan, Tralee, Clonmel, Portlaoise, Waterford, Drogheda	Rk_c, Rk_d, Rf, Lm aquifers, SAC, or source of existing public water supply
Productive Aquifers, Lower Risk	Cork, Castlebar, Newbridge, Tullamore, Balbriggan	Rk_c, Rk_d, Rf, Lm aquifers, No SACs
Poorly Productive Aquifers, Higher Risk	Maynooth, Leixlip, Dublin, Wexford, Letterkenny, Athlone, Dundalk, Greystone	Ll, Pl, Pu aquifers, GWDTE, SAC, groundwater used by industry
Poorly Productive Aquifers, Lower Risk	Mullingar, Bray, Celbridge, Malahide, Carrigaline, Naas	Ll, Pl, Pu aquifers
Sand and Gravel aquifers – imply higher risk	Kilkenny, Carlow, Newbridge	S&G implies higher attenuation potential

Poorly productive aquifers represent a particularly challenging hydrogeological environment in Ireland. As described in Section 2.6, the infiltration and recharge capacities of PPAs are limited, which implies that rejected recharge will try to find alternative shallow pathways to receptors. Thus, shallow pathways, including runoff, are expected to be particularly dominant in urban areas underlain by poorly productive rock types.

3.2.1 Identified Data Gaps

The risk ranking uncovered numerous data gaps relating to source, pathway and receptors factors. **Table 13** summarises the key data required and used, sources of information, challenges faced when using the data, as well as data gaps. The most significant data gaps relate to sources and pathways. In particular, information about sewer integrity and exfiltration potential is sketchy, despite the efforts undertaken during the NUWWS. For pathways, vulnerability is the main risk factor, but in some of the larger cities, vulnerability mapping has not yet been undertaken by the GSI, and in such cases, a high vulnerability category is assumed by default, which in some instances may overstate or understate actual risk.

Specific data gaps are addressed in Section 5, Programmes of Measures.

Table 13: Summary of Data Used and Associated Data Gaps

		Attribute	Data Source	Data Format/ Type	Data/Information Gaps
Source	Land use	**Industrial Development**	Local Authorities and EPA	GIS - land use zoning	Consistency in land use classifications; common definitions of land uses and boundaries
		Contaminated Land	EPA	EPA records	Consistency in sampling and reporting; well locations
		Manufacturing	EPA	EPA IPPC licences	Consistency in sampling and reporting; well locations
		Landfills	EPA	EPA Waste licences	Consistency in sampling and reporting; well locations
		Airports	OSI	Map locations	
		Roads	OSI	GIS layer	Mapping of secondary roads not available;
		Railways	Irish Rail/ OSI	Locations of maintenance yards	
		Amenity open space	Local Authorities	Land use zoning GIS	Pesticide and fertilisers use.
	Sewers	**Sewer Length, Density**	NUWWS & GDSDS reports	Statistics from reports. Sewer network modelling.	Approximate sewer lengths and catchment areas known. Integrity information is sketchy. No information on sewer elevations in relation to groundwater. Exfiltration estimates not possible.
	Climate	**Effective rainfall**	Met Eireann	GIS layer	
Pathway	Vertical	**GW vulnerability**	GSI	GIS layer	Lack of resolution in areas not yet mapped by the GSI.
	Horizontal	**Flow regime**	GSI	GIS layer	
Receptor		**Ecological**	NPWS and DEHLG	GIS layer - SACs and GWDTE	Detailed delineations of GWDTE boundaries. Site-specific information on environmental supporting conditions. Baseline monitoring.
		Groundwater body	RBDs compiled data; GSI	Groundwater Abstractions	The existing abstractions register probably underestimates the number of industrial/commercial wells in urban footprints.
			EPA	Source protection areas	Detailed zones of contribution for public supply wells in urban footprints

4. Groundwater Quality

With the exception of individual IPPC, waste, and contaminated land sites, urban groundwater has not been systematically monitored in the past. Because monitoring at individual sites tends to target areas in the immediate vicinity of a facility, a broader synthesis of urban groundwater quality in the WFD context has not yet been compiled.

The lack of broad, systematic monitoring in the past primarily reflects the fact that urban groundwater is not a significant source of public water supply in Ireland. Nonetheless, limited datasets of groundwater quality exist, and these have been collated and compared to drinking water standards as defined by S.I. No. 278 of 2007, European Communities (Drinking Water) (No. 2) Regulations 2007.

In the absence of dedicated, long-term monitoring networks in urban areas, the data presented in this report should be regarded as a first step towards judging predictive risk assessments and whether or not there is evidence to show that urban GWBs are impacted by urban pressures.

4.1 Groundwater Quality Datasets

Table 14 shows the breakdown of existing datasets in the 33 urban areas included in this study. The vast majority of available data is associated with EPA's IPPC and waste-licensed facilities. The data reside in records kept by EPA's regional licensing and enforcement offices in Dublin, Wexford, Cork and Castlebar.

These datasets were supplemented by results of a groundwater sampling programme that was carried out as part of this FC study between July 2007 and June 2008.

4.1.1 IPPC Facilities

As summarised in **Table 15,** groundwater quality monitoring takes place at 40 IPPC licensed facilities within the 33 urban footprints included in the study. Groundwater quality data were obtained for one or more years during the period 2003-2008 for 37 of the 40 facilities, covering 16 towns. Dublin alone incorporates 17 of the 37 facilities. The following towns have two or more IPPC facilities with some degree of groundwater monitoring: Dublin, Dundalk, Carlow, Cork, Clonmel, Drogheda, Swords, Sligo and Waterford.

As a general comment, the reporting requirements for individual facilities vary widely in terms of the number of wells sampled, sampling frequency, determinands reported, and detection limits achieved. The type and frequency of monitoring is specific to licence requirements stipulated by the EPA. For this reason, the data do not allow for a direct or consistent comparison of groundwater quality in any given hydrogeological setting. Nonetheless, the data are useful and valuable indicators of groundwater quality in any given setting.

4.1.2 Waste License Facilities

As summarised in **Table 16**, there are 20 existing waste license facilities within 12 urban areas that are required under waste license terms and conditions to monitor groundwater quality on a routine basis. Eight of the 20 facilities are landfill-related while the remaining 12 represent: waste transfer stations (3), soil remediation facilities (3), and hazardous waste facilities (6). Of the total 20 facilities, 6 are located in Dublin.

Associated groundwater quality data were obtained through EPA regional offices, and their use is subject to the same cautions highlighted for IPPC facility data.

Table 14: Summary of Existing Urban Groundwater Quality Datasets

Urban Area	River Basin District	EPA Groundwater Quality Sites	Drinking Water Quality Sites (GW)	Previous Studies or One-off Sampling	IPPC & Waste Facilities
Athlone	ShRBD	✗	✗	✓	✗
Balbriggan	ERBD	✗	✗	✗	✗
Bray	ERBD	✗	✗	✗	✗
Carlow	SERBD	✓	✗	✗	✓
Carrigaline	SWRBD	✗	✗	✗	✗
Castlebar	WRBD	✗	✗	✗	✗
Celbridge	ERBD	✗	✗	✗	✗
Clonmel	SERBD	✗	✗	✗	✓
Cork	SWRBD	✗	✗	✗	✓
Drogheda	ERBD	✓	✓	✗	✓
Dublin	ERBD	✗	✗	✓	✓
Dundalk	NBRBD	✓	✗	✓	✓
Ennis	ShRBD	✗	✗	✓	✓
Galway	WRBD	✗	✗	✓	✓
Greystones	ERBD	✗	✗	✗	✗
Kilkenny	SERBD	✓	✗	✗	✓
Killarney	SWRBD	✗	✗	✗	✓
Leixlip	ERBD	✗	✗	✗	✓
Letterkenny	NWRBD	✗	✗	✗	✓
Limerick	SRBD	✗	✗	✓	✓
Malahide	ERBD	✗	✗	✗	✗
Maynooth	ERBD	✗	✗	✗	✗
Mullingar	ShRBD	✗	✗	✗	✓
Naas	ERBD	✗	✗	✗	✓
Navan	ERBD	✗	✗	✗	✓
Newbridge	ERBD	✗	✗	✗	✓
Portlaoise	SERBD	✓	✓	✗	✓
Sligo	WRBD	✗	✗	✗	✓
Swords	ERBD	✗	✗	✗	✓
Tralee	ShRBD	✓	✗	✗	✗
Tullamore	ShRBD	✗	✗	✗	✓
Waterford	SERBD	✗	✗	✗	✓
Wexford	SERBD	✗	✗	✗	✓

Table 15: Summary of IPPC Facilities in Urban Areas with Groundwater Monitoring

IPPC Facility No.	Urban Area	Groundwater Monitoring Frequency	No. Monitoring Wells	Overall Compliance [1]	Physio-chemical	Inorganic [2,4]	Metals [3,4]	Organics [4]	Notes
P0008-01	Dublin	Annual	3	Y					Only TOC is monitored
P0014-03	Swords	6 monthly	9	N	Y	Y	N	Y	
P0019-01	Dublin	Annual	3	N	Y	Y	Y	Y	
P0027-02	Clonmel	Quarterly	6	Y	Y	Y	Y	N	Onsite landfill
P0050-02	Dublin	6 monthly	-	-	-	-	-	-	-
P0060-01	Swords	Annual	8	N	Y	Y	N	Y	
P0062-02	Wexford	6 monthly	-	-	-	-	-	-	-
P0078-01	Dublin	Annual	4	N	Y	Y	Y	Y	
P0079-03	Dublin	6 monthly	10	Y	Y	Y	N	N	
P0081-02	Dublin	Annual	1	N	Y	Y	Y	Y	
P0083-01	Swords	Every 2 years	2	Y	Y	Y	N	Y	
P0117-01	Dublin	Annual	3	N	Y	Y	Y	Y	
P0125-01	Dublin	Annual	3	N	Y	Y	Y	Y	Onsite landfill
P0142-01	Galway	None	4	Y	Y	Y	N	N	
P0153-04	Newbridge	6 monthly	4	Y	Y	Y	Y	N	
P0157-02	Waterford	Every 2 years	3	Y	Y	N	Y	N	
P0167-01	Dublin	Annual	1	Y	Y	Y	N	N	
P0207-03	Leixlip	6 monthly	10	Y	Y	Y	Y	N	
P0222-01	Carlow	Monthly	7	Y	Y	Y	N	N	
P0231-01	Dublin	Annual	1	N	Y	Y	N	Y	Potential 3rd party contamination
P0235-01	Letterkenny	Every 2 years	2	N	Y	Y	Y	Y	

IPPC Facility No.	Urban Area	Groundwater Monitoring Frequency	No. Monitoring Wells	Overall Compliance [1]	Physio-chemical	Inorganic [2,4]	Metals [3,4]	Organics [4]	Notes
P0239-01	Naas	Annual	5	N	N	N	Y	Y	
P0275-01	Dublin	Annual	3	N	Y	Y	Y	Y	
P0284-02	Dublin	Annual	2	Y	Y	Y	N	N	
P0287-01	Carlow	Every 2 years	1	Y	Y	Y	Y	Y	
P0376-01	Drogheda	Annual	1	N	Y	Y	Y	N	
P0392-01	Dublin	Once off	3	N	Y	Y	Y	Y	
P0440-01	Dundalk	Annual	3	Y	N	N	N	Y	Only monitor DRO and mineral oils
P0443-01	Clonmel	6 monthly	3	Y	Y	Y	Y	Y	
P0448-01	Kilkenny	6 monthly	5	Y	Y	Y	N	Y	
P0449-02	Waterford	Annual	7	N	Y	Y	N		
P0508-02	Dundalk	Annual	5	Y	Y	Y	N	Y	
P0522-01	Dublin	Annual	3	N	Y	N	N	Y	
P0525-01	Waterford	Annual	-	-	-	-	-	-	-
P0532-01	Dublin	Annual	8	Y	Y	Y	N	N	
P0551-01	Killarney	6 monthly	4	N	Y	Y	Y	Y	
P0552-01	Dublin	Quarterly	10	Y	N	Y	N	Y	
P0578-02	Cork	Annual	4	Y	Y	Y	N	Y	
P0643-02	Sligo	6 monthly	4	Y	Y	Y	Y	Y	
P0648-01	Dublin		7	N					Ongoing investigation

Note:

[1] - compliance records indicate pollutants are found in excess of EQOs - mostly for ammonium, conductivity, mineral oils and petroleum products

[2] - mainly ammonium, conductivity, chloride

[3] - range of metals analysed varies widely

[4] - not consistently reported

Table 16: Waste License Facilities in Urban Areas with Groundwater Monitoring

	Facility No.	Urban Area	Groundwater Monitoring Frequency	No. Monitoring Wells	Overall Compliance [1]	Physio-chemical	Inorganic [2,4]	Metals [3,4]	Organics [4]
Landfill	W0012-01	Cork	Quarterly	5	N	Y	Y	Y	N
	W0018-01	Waterford	Quarterly	9	N	Y	Y	Y	Y
	W0031-01	Ennis	Quarterly	10	N	Y	Y	N	N
	W0033-01	Drogheda	Quarterly	9	N	Y	Y	Y	Y
	W0034-02	Dundalk	Quarterly	7	N	Y	Y	Y	N
	W0076-01	Limerick	Quarterly	11	N	Y	Y	Y	Y
	W0127-01	Dublin	Quarterly	9	N	Y	Y	Y	Y
	W0141-01	Cork	-	-	-	-	-	-	-
Other Waste Licence	W0036-02	Dublin	Quarterly	2	Y	Y	Y	Y	Y
	W0058-01	Sligo	Quarterly	2	Y	Y	Y	N	N
	W0099-01	Dublin	Annual	1	N	Y	Y	N	Y
	W0104-01	Tullamore	Annual	-	-	-	-	-	-
	W0113-02	Tullamore	Annual	2	Y	Y	Y	Y	N
	W0115-01	Mullingar	Annual	4	Y	Y	Y	N	Y
	W0131-02	Navan	Biannually	4	Y	Y	Y	Y	Y
	W0137-01	Dublin	Quarterly	5	N	Y	Y	Y	Y
	W0164-01	Dublin	Quarterly	32	Y	Y	N	N	Y
	W0184-01	Portlaoise	Quarterly	7	N	Y	N	N	Y
	W0190-01	Waterford	Quarterly	9	N	Y	N	Y	Y
	W0196-01	Dublin		-	-	-	-	-	-

[1] - compliance records indicate pollutants are found in excess of EQOs - mostly for ammonium, conductivity, mineral oils and petroleum products

[2] - mainly ammonium, conductivity, chloride

[3] - range of metals analysed varies widely

[4] - not consistently reported

4.1.3 Contaminated Land Sites

As summarised in **Table 17**, there are an estimated 36 contaminated land sites within the 33 urban areas studied. All of the sites are IPPC or waste-licensed facilities. Towns with more than one EPA-designated contaminated land site are Dublin, Waterford, Wexford, and Swords. 12 of the total 36 sites are located in Dublin, while 6 are located in Waterford.

Table 17: Summary of Contaminated Land Sites in Urban Areas

Licence Number	Urban Area	EPA Licence Status	WFD 2008 Risk Assessment [1]
P0012-04	Ennis	Active	At risk
P0014-04	Swords	Active	At risk
P0019-02	Dublin	Active	At risk
P0060-01	Swords	Active	Not at risk
P0062-02	Wexford	Active	At risk
P0066-02	Waterford	Active	At risk
P0078-01	Dublin	Active	At risk
P0093-01	Waterford	Active	At risk
P0109-01	Dublin	Ceased	Not at risk
P0111-01	Dublin	Ceased	Not at risk
P0123-01	Mullingar	Active	Not at risk
P0142-01	Galway	Active	At risk
P0164-01	Dublin	Active	At risk
P0217-01	Dublin	Active	Not at risk
P0225-01	Clonmel	Facility Closed	At risk
P0239-01	Naas	Active	Not at risk
P0250-01	Dublin	Active	At risk
P0326-01	Dublin	Active	At risk
P0353-01	Sligo	Active	Not at risk
P0376-01	Drogheda	Active	At risk
P0385-01	Waterford	Active	At risk
P0436-01	Limerick	Active	At risk
P0448-01	Kilkenny	Active	Not at risk
P0468-01	Dublin	Active	At risk
P0472-01 W184-01	Portlaoise	Active	At risk
P0486-01	Dublin	Active	At risk
P0520-01	Waterford	Facility Closed	Not at risk
P0525-01	Waterford	License under review	At risk
P0532-01	Dublin	Active	Not at risk
P0648-01	Dublin	Active	Not at risk
W0131-02	Navan	Active	At risk
W190-01	Waterford	Closed	Not at risk
P0105	Bray	Closed	
P0256	Wexford	Closed	Not at risk
P0286	Celbridge	Closed	Not at risk
P0287	Carlow	Closed	Not at risk

Note:
[1] – The risk assignment refers to the 2008 update and revision as defined by the EPA and Shannon RBD. The definitions of risk categories are the same as those reported by EPA to the European Commission in 2005 per WFD requirements (EPA, 2005a): “At risk” = at risk of not meeting WFD status objectives in 2015; “Not at risk” = expected to meet WFD status objectives in 2015.

Twenty sites are subject to active and routine groundwater quality monitoring associated with remediation or post-remediation activities. Nine sites no longer involve groundwater monitoring, either because they have been decommissioned or because contamination is restricted to soils.

A separate FC study implemented by the Shannon RBD project has re-evaluated the Article 5 risk assessment of contaminated land sites following a review of EPA site inspection reports in 2006 through 2008. Using the WFD risk classification scheme that is described in the Article 5 report (EPA, 2005a), 20 of the 36 sites are deemed to be "at risk" (from not meeting WFD objectives by year 2015) while the remaining 16 are deemed to be "not at risk" (Shannon RBD, 2008), implying that no groundwater contamination is evident or that a site has been remediated or decommissioned.

4.1.4 Other Wells

A groundwater sampling programme was carried out as part of this FC study to test groundwater quality in a range of higher-risk and lower-risk towns in an effort to verify the likelihood of impact to groundwater quality. Existing urban wells, mostly abstraction wells, were sampled and analysed for a wide range of determinands covering: a) indicator compounds that would be expected in an urban setting; and b) EPA's priority list of determinands as set forth in their WFD monitoring programme (EPA, 2006).

Early discussions had been held on the merits of installing a limited set of new monitoring wells within one urban area, with alternative objectives of focussing on a single pressure type such as road runoff or establishing a first dedicated network within a single town. Opportunities for installing a dedicated network proved difficult within the timeframe of the study. Given the bigger-picture objectives of the FC study, providing a "screen-shot" of urban groundwater quality in different settings was favoured over focussing on a single urban pressure.

The approach adopted for the sampling was therefore to conduct "random" sampling from existing abstraction wells representative of different urban land uses, recognising that such wells would draw on a larger volume of urban groundwater due to their larger zones of contribution.

More than 160 industrial wells within the study areas were identified from a GSI database of wells, as well as a national abstraction register collated from RBD information. These wells were ground-truthed and screened for sampling purposes by checking their current status (usage) and integrity (apparent construction details – to check whether the wells would provide representative groundwater samples) and whether or not raw groundwater samples could be collected at the wellhead. The associated land uses upgradient of each potential well was checked and verified. The selected wells represent a combination of different land uses: city centre, light industrial, mixed use, and residential. Wells located downgradient of known or suspected point sources were not included to avoid skewing the results.

Of the 160+ wells initially identified, approximately 100 suspected well owners were contacted and the existence of 55 wells was verified. Of these, 27 wells were deemed suitable for sampling purposes. Of these, permission to sample was received from 22 individual well-owners.

With the exception of three wells, all wells selected were used for industrial/commercial purposes. The three exceptions were public supply wells near the perimeters of Drogheda and Portlaoise, whose zones of contribution partly overlap with urban land uses. They were included because they are public sources of water supply.

Four quarterly rounds of sampling in a total of 12 different urban areas were carried out between July 2007 and June 2008. In the first round, 20 wells were sampled in 11 urban areas. In subsequent rounds, some wells were omitted from the programme, either because the well was inaccessible (stopped pumping or well owner changed their mind) or because the absence of pollutants had been confirmed in an earlier round. A summary of the wells sampled is provided in **Table 18** while **Appendix C** contains the details on each of the wells, including their location, sampling point and the land uses they represent.

Table 18: Summary of Wells Sampled

Urban Area	Round (No. wells)				Comment
	1st	2nd	3rd	4th	
Balbriggan	1	1	1	1	
Carlow	1	1	0	0	No evidence of contamination
Cork	2	1	0	0	Saline
Drogheda	4	4	2	0	PWS, marginal urban, also covered by EPA sampling
Dublin	4	2	2	2	One well decommissioned during the year, another taken offline
Kilkenny	1	1	0	0	No evidence of contamination
Limerick	1	1	1	1	
Naas	1	0	0	0	Representivity of sample questioned following review of Round 1 result
Portlaoise	1	0	0	0	PWS, marginal urban, also covered by EPA sampling
Tralee	1	1	1	0	No evidence of contamination
Waterford	3	3	3	3	
Wexford	0	1	0	1	Difficulties with pump
Total	*20*	*16*	*10*	*8*	

4.2 Findings of Impact

Urban groundwater quality has been examined in two ways:

- By summarising "ambient" groundwater quality within urban footprints (using all available data, but excluding wells that are located downgradient or in direct vicinity of known point sources of pollution);

- By calculating area-weighted concentrations within urban footprints (using all available data, and including wells that are located downgradient or in direct vicinity of known point sources of pollution).

The area-weighted concentration represents the overall quality within an urban footprint, and was calculated as follows:

[(Polluted area x Estimated average concentration in polluted area) + (Area of the remainder of the urban footprint x Estimated concentration in this area)]/Total area of urban footprint

Calculations included all parameters for which a drinking water standard (DWS) exists. The methodology follows the same approach used by the EPA in the status classification of GWBs that may be impacted by pollution from contaminated land sites (Shannon RBD, 2008). In the above equation, a "polluted area" of 0.25 km^2 was used as default, unless facility-specific information on plume dimensions was available. A 0.25 km^2 polluted area is considered to be conservatively large in most instances. It is consistent with an impacted area of 500 m x 500 m. Plumes that develop from contaminated sites are shaped by the geometry of the source area, the prevailing hydraulic gradients away from the site, and the hydraulic properties of rocks through which the contaminants migrate.

Using site investigation data from a facility in Dun Laoghaire, in granitic bedrock, a plume length of approximately 500 m was calculated for a constant (active) source over a 40-year period and a "conservative" tracer that is not subjected to natural attenuation. The width of the facility is only about 300 m, so the "worst-case" plume area in this case is 0.15 km^2. Aquifer types that are more transmissive or conductive would result in longer plumes for the same source-period, however, few of the facilities in question are 40 years old.

Water quality data were only used quantitatively if the wells and water samples represent a formally designated GWB, per EPA's Article 5 characterisation report. For example, the Dublin urban GWB is represented by the "Calp" limestone which underlies most of the city, but not the shallow sand and gravel deposits which are only found in city centre along the Liffey and harbour area. In the latter case, data were assessed qualitatively by checking for individual DWS exceedances and indicator compounds of pollution.

Findings are presented in Section 4.2.1, and full analytical details are provided in **Appendix D**. Because the available data are derived from a multitude of sources, the data must be regarded with some degree of caution, and the following qualifiers apply:

- The wells representing upgradient ("background") concentrations are mostly known, but in a few instances, well locations are inferred from text descriptions or the data itself (e.g., water quality has clearly not been impacted). Where locations are not known or cannot be inferred, associated data were not used.

- The population of data for any given parameter in any given town varies, reflecting different reporting requirements to the EPA for any given facility. For example, in Dublin, one facility might only be required to measure TOC, and if the TOC value exceeds some threshold, this triggers an additional sample to be collected which is analysed for an expanded list of parameters. Other facilities might be required to analyse for a wide range of chemicals.

- A parameter that is typically included in all facility licenses is electrical conductivity, hence the database for electrical conductivity is better than for a parameter which is rarely, if ever, reported (e.g., *E. Coli*, pesticides).

- Some data tables do not include units, or obvious errors in reporting of units occur, e.g., mg/L is reported where the unit should clearly be µg/L. In such cases, units were inferred or corrected.

- For metals, it is not specified whether the analyses represent filtered vs. unfiltered samples. From a review of the data, it would appear that most, if not all, samples are filtered.

- Different facilities have different reporting schedules to the EPA, and so the last data available in EPA records were used. Some data represent 2007 or 2008, but can go back to 2006 or in a few instances, late-2005.

- Some facilities report single values in a given year, and it is not always clear whether the result is a single sample or an average over a certain time-period. Where a single data value is reported, this value was used. Where more than one sample is available for a given year, an average was calculated as appropriate. Individual facility data show significant fluctuations of concentrations of individual parameters in any given year.

- Pesticide data are largely absent, and where pesticides are reported, the list of analytes tends to be very different from EPA's priority list of pollutants established in late 2006 for WFD purposes.

- The form of reported ammonium and nitrate is not always clear. It is inferred based on text descriptions as well as data comparisons to other wells within the same groundwater body. Ammonium is reported as a mix of ammonium, ammonia, NH_4-N, or ammoniacal nitrogen. Nitrate is reported as nitrate, nitrate-N, NO_3or as NO_3-N. For the data analysis, data were consistently applied as the nitrate form of nitrate (i.e., NO_3 as NO_3).

Despite these qualifiers, review of the available data sets represents a first comprehensive attempt at describing urban groundwater quality across Ireland. The review also highlights some obvious measures that may be needed in the future to define future monitoring needs and improve on the collective knowledge of urban groundwater resources. Relevant proposed measures are described in Section 5.

In all urban areas, findings of ambient and overall groundwater quality are considered "indicative" rather than "representative". Only five towns or cities have data from more than three wells; Dublin, Waterford, Drogheda, Dundalk, and Swords. The majority of available data relate to Dublin and Waterford. Some urban areas do not have monitoring data at all, and so no direct conclusions can be drawn from these towns. Transposing results from similar urban areas (land use, size, geology, etc.) is not believed to be possible, as each urban area is unique in terms of pressures and hydrogeology.

4.2.1 Ambient Groundwater Quality

Resulting "ambient" groundwater quality for urban areas with relevant groundwater quality data are presented in **Appendix E**. Results are summarised in **Table 19**, in context of these water quality thresholds:

- EC DWS;
- 75% of the EC DWS, used by the EPA as a lower threshold for qualitative (chemical) status classification.

EPA's Interim Guidance Values (IGVs) (EPA, 2003) were used for those parameters that do not have officially assigned DWSs. IGVs have been used by EPA in the past to assess groundwater quality.

Two cities, Dublin and Cork, are impacted by saline water locally. In Dublin, one saline well in the Sandymount/Ringsend area skews the statistics, and when this well is removed from the statistical analysis, the resulting ambient value for electrical conductivity is below the 75% DWS threshold. The salinity in the Sandymount/Ringsend monitoring well is naturally influenced by seawater, as it is located within the tidal influence of Dublin harbour.

The elevated salinity in the Cork city wells is also of a natural origin. UCC has conducted several studies of groundwater within the Lee Valley and surrounding areas, including the city centre (Allen, 2007). Cork city is underlain by a deep buried valley consisting of highly permeable sands and gravels, and occupies a reclaimed marsh area entirely surrounded by the tidal estuary in Cork harbour. Allen and Milenic (2003) report normal tidal variations of 2-3 metres with a very shallow water table (<30 cm from street level at high tide) in some parts of the city centre. As a result, groundwater quality is brackish or saline and this has reportedly a corrosive effect on underground engineering structures and piping.

Losses from water main leaks are reportedly approximately 40% of total supply through the water distribution network, amounting to an estimated 26,000 m^3/day. Past reports of groundwater quality beneath Cork indicate that it has been influenced by foul and storm water overflows from the sewer system during flood events (Allen, 2007). Milenic (2004) reports evidence of failure of the old sewer system in the city centre. Besides salinity, the sewage influence is evident in the data presented in Table 19, with detection of both *E. Coli* and total coliforms. The recent construction associated with the Cork Main Drainage Scheme will have done much to alleviate future groundwater impacts.

It should be pointed that the formal urban Cork GWB is the karstic limestone beneath the sand and gravel deposits of the Lee Valley. The buried valley deposits are up to 60 m deep, and there are no wells within the underlying karstic limestone in the study area.

Table 19: Summary of Ambient Groundwater Quality

		Parameter	Conductivity	E.Coli (presumptive)	Total Coliform (presumptive)	Ammonium	Chloride	Phosphorus (React)	Sulphate	Aluminium	Boron	Cadmium	Iron	Magnesium	Manganese	Nickel	Potassium	Sodium	Atrazine
		Units	µS/cm	CFU/100ml	CFU/100ml	mg/l as N	mg/l	mg/l as P	mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	mg/l	mg/l	µg/l
		DWS	2500	0	0	0.3	250	n/a	250	200	1000	5	200	n/a	50	20	n/a	200	0.1
		IGV						0.03						50			5		
		75% of DWS	1875			0.225	187.5	n/a	187.5	150	750	3.75	150	n/a	37.5	15	n/a	150	0.075
	Wells [1]	Observations [2]																	
Dublin	**30**	**19**	**2643 (826) [3]**	<1	**147**	**0.9**	**261**	0.02	**249**	18	581	0.3	**1048**	17	**285**	4.6	**24.6**	**293**	<0.05
Waterford	**20**	**17**	331	**2**	**13**	0.03	26	0.012	38	15	210	<0.3	103	12	10	7.5	2	19	<0.05
Balbriggan	**4**	**4**	575	<1	**129**	<0.01	43	0.0	60	4	72	<0.3	35	20	**98**	4.3	3.1	25	<0.05
Carlow	**4**	**3**	516	0	**9**	0.01	23	<0.01	61	3	<32	<0.3	23	28	27	**16**	1	11	<0.05
Cork	**4**	**3**	**15195**	**15**	**57**	**0.3**	**3392**	**0.06**	**1102**	11	**2556**	0.8	117	**567**	**411**	<2	**242**	**4471**	<0.05
Drogheda	**5**	**4**	586	**5**	**69**	0.03	44	**0.038**	58	4	21	0.3	109	50	**140**	**16**	2.8	41	**0.1**
Kilkenny	**3**	**3**	590	0	0	0.1	27	**0.03**	16	4	<32	<0.3	5	26	4	<2	1	9	<0.05
Limerick	**5**	**5**	594	<1	**12**	0.2	21	0.0	35	7.3	43	<0.9	46	23	4	1.6	3	15	<0.05
Naas	**2**	**2**	478	**1**	**8**	0.1	14	0.0	37	44	64	<0.3	**659**	17	**445**	1.5	1	9	<0.05
Tralee	**3**	**3**	337	<1	**1**	0.02	23	0.013	8	16	<32	<0.03	**301**	4	**131**	5.3	0.7	13	<0.1
Wexford	**2**	**2**	1010	0	**1911**	0.01	116	0.0	37	32	52	<0.3	**3593**	37	**507**	2	**7**	96	<0.02
Swords	**3**	**3**	1192	-	-	0.09	117	**0.04**	110	0.01	63	**7.0**	20	40	**600**	8	**5.6**	70	-
Navan	**1**	**1**	830	-	-	0.1	27	-	54	3	23	<2	167	37	7	11	2	18	-
Clonmel	**2**	**2**	-	-	-	0.14	31	**3.84**	11	**308**	-	<0.1	148	11	**68**	6.6	-	-	-
Leixlip	**1**	**1**	703	-	-	<0.2	28	**0.05**	81	-	-	<5	**670**	23	20	<10	1.5	12	-
Clonmel	**2**	**2**	690	0	-	**1.1**	39	-	22	-	23	<0.4	31	14	30	0.9	0.7	24	-
Ennis	**2**	**2**	561	-	-	**0.9**	25	-	-	-	-	-	-	-	-	-	3.5	20	-
Sligo	**2**	**2**	517	-	**8**	**2.4**	75	**0.18**	79	0.2	-	5.0	140	-	17	<10	-	-	-
Tullamore	**1**	**1**	496	-	**1**	-	13	-	-	**210**	-	-	**340**	13	**2190**	<0.1	2.1	12	-

"—" = no data
[1] – maximum number of wells for which any groundwater data is available in period 2005-2008.
[2] – maximum number of reported concentrations for any given parameter on which average concentrations are calculated.
[3] – wells at Ringsend show evidence of saline water – average conductivity value, excluding saline wells, is shown in parenthesis.

The following general observations can be made from **Table 19**:

- Total coliforms, ammonium and orthophosphates are detected in several towns, suggesting a sewer influence on groundwater quality.
- Neither nitrate nor nitrite exceeded their DWSs in any town for which data are available.
- Excluding Cork, which is seawater influenced, boron is considerably higher in Dublin and Waterford than in other towns.
- Fluoride was not exceeded in any town for which data are available.
- The iron and manganese standards are exceeded in many towns, and are generally thought to be of natural origins.
- Heavy metals are generally below their respective DWS thresholds. Cadmium was exceeded in Swords, and nickel in Drogheda.
- While it does not have a DWS, zinc was detected at elevated levels (above 100 µg/L) in Waterford, Naas, and Navan. Zinc may be naturally occurring.
- Pesticides are generally absent in the tested wells. Atrazine and simazine (two triazine group herbicides) were detected in Drogheda and Waterford. The well in Drogheda is located in a marginal urban setting, and the detections may be attributed to agricultural practices as much as an urban source.
- PAHs and SVOCs are largely absent from the wells tested.
- Trace levels of VOCs were detected at low concentrations (<10 µg/L, and mostly <1 µg/L) in Dublin, Waterford, Balbriggan, Carlow, Drogheda, Limerick, Tralee, and Wexford. These detections are deemed to be indicative of urban pressures. The detections in Waterford especially are thought to be related to groundwater contamination in the industrial estate in the southwestern part of the city (see Section 4.2.2).

In summary, ambient groundwater quality, as defined in this report, is generally below DWSs in all of the towns for which data are available. There are a few elevated detections and exceedances of parameters that are indicative of urban impacts. Precise sources and extents for each of the exceedances cannot be verified without site-specific study.

4.2.2 Overall Groundwater Quality

As presented in **Table 20,** area-weighted groundwater concentrations have been calculated for parameters with DWSs in Dublin, Waterford, Drogheda, and Swords. These are the only towns that have extended groundwater quality datasets. The remaining towns may have one or two such sites, but on review, these are not deemed to be sufficient to draw conclusions about impacts across urban footprints.

Table 20: Overall Groundwater Quality in Four Urban Areas

	Unit	75% DWS	IGV	Waterford Assessment Area 41.65km² Average of Ambient GW Quality	Waterford No. of impacted Sites 7 Area weighted average	Dublin Assessment Area 288.34km² Average of Ambient GW Quality	Dublin No. of impacted sites 10 Area weighted average	Swords Assessment Area 11.83km² Average of Ambient GW Quality	Swords No. of impacted sites 1 Area weighted average	Drogheda Assessment Area 12.62km² Average of Ambient GW Quality	Drogheda No. of impacted Sites 1 Area weighted average
Conductivity	µS/cm	1875		331	364.9	826	869	1192.3	1262	585.8	802.5
pH		6.5 - 9.5		6.7	6.7	7.57	7.57	7.2	7.7	7	7.2
Escherichia coli	0 counts per 100ml	0		2.4	**2.3**	0	0	nd	nd	nd	<1
Total Coliform	0 counts per 100ml	0		13.3	**16**	146.6	**147**	nd	nd	68.8	66.2
Ammonium	mg/l as N	0.225		0.03	**1.1**	**0.5**	**0.7**	0.09	0.13	0.03	0.03
Arsenic	µg/l	7.5		<1	0.61	3.9	3.9	<1	<1	1.3	1.3
Chloride	mg/l	187.5		26	33	42	45	117	122	44	44
Cyanide	µg/l	37.5		<2	1	<1	<1	<1	<1	12	12
Fluoride	mg/l	0.6		<0.1	0.05	**0.8**	**0.8**	0.06	0.07	0.12	0.12
Nitrate	mg/l	37.5		7.1	7.3	2.2	2.3	11.1	10.8	2.5	2.5
Nitrite	mg/l as N	0.375		<0.005	0.003	<0.01	<0.01	<0.01	0.01	0.011	0.011
Phosphorus (React)	mg/l as P		0.03	0.012	0.02	0.013	0.01	<0.03	<0.03	**0.04**	<0.03
Sulphate	mg/l	187.5		38.4	39.3	132	132.4	110	107.7	58.2	68.7
Aluminium	µg/l	150		15	15.9	18	18	<0.002	0.7	4.2	4.2
Antimony	µg/l	3.75		<1	<1	<5	<5	nv	nv	<1	<1
Boron	µg/l	750		210	232	389	390	63	62	40	40
Cadmium	µg/l	3.75		0.3	0.4	0.2	0.2	**7**	**6.8**	1	1
Chromium	µg/l	37.5		2.1	2.2	8.9	8.9	10	9.8	5.8	7.2
Copper	µg/l	1500		4.2	4.6	5.8	6	3	2.9	43.2	44.3
Iron	µg/l	150		103	129	**1143**	**1151**	20	20	109	109
Lead	µg/l	7.5		4	4.2	3.1	3.2	5	4.9	1.5	<3
Manganese	µg/l	37.5		10.3	**58.5**	**250**	**253.2**	**600**	**587**	**140**	**137**
Mercury	µg/l	0.75		<0.2	<0.2	<0.1	<0.1	<0.1	0.05	<0.2	<0.2
Nickel	µg/l	15		7.5	7.8	3.7	3.9	8	7.8	**16**	**16.3**
Potassium	mg/l		5	2	2.0	3.2	3.2	**5.6**	**5.5**	2.8	2.9
Sodium	mg/l	150		19	22.9	40.5	41	70	68.7	41.1	40
Zinc	µg/l		100	22.8	25.2	42.5	43	81	78.5	18.4	17.9
Ind. Pesticide	µg/l	0.1		nd	nd	nd	nd	nd	**0.15**	**0.4**	**0.4**
Total Pesticide	µg/l	0.5		nd	nd	nd	nd	nd	0.15	**0.56**	**0.56**
Benzene	µg/l	0.75		nd	**4**	nd	0.04	<1	<1	0.06	<0.12
Benzo(alpha)pyrene	µg/l	0.075		nd	nd	nd	nd	<1	<1	<1	<1
Tetrachloroethene	µg/l			nd	0.09	nd	0.05	<1	<1	0.26	0.26
Trichloroethene	µg/l			nd	9.7	nd	3.0	<1	<1	0.01	<0.02
Vinyl Chloride	µg/l	3.75		nd	0.5	nd	0.03	<1	<1	<0.1	<0.1
Total PAH	µg/l	0.01		nd	nd	nd	nd	<1	<1	<1	<1
TCE + PCE	µg/l	7.5		nd	**9.8**	nd	2.9	<1	<1	0.26	0.28
1,2-dichloroethane	µg/l	2.25		nd	nd	nd	0.01	<1	<1	nd	nd

nd = no data

In the four towns in question, individual sites show exceedances for many parameters, including metals and VOCs. Some sites are also affected by chemical parameters for which DWSs do not exist.

4.2.2.1 Dublin

Figure 12 shows the locations of wells or facilities for which data have been used. The associated area-weighted average concentrations presented in **Table 20** exceed EPA's water quality thresholds for total coliforms, ammonium, fluoride, iron and manganese. The latter two are likely of natural origin, while total coliforms and ammonium are indicative of urban pressures (sewer exfiltration or infiltration of diffuse runoff). Fluoride could be naturally occurring but could also be related to leaking water mains.

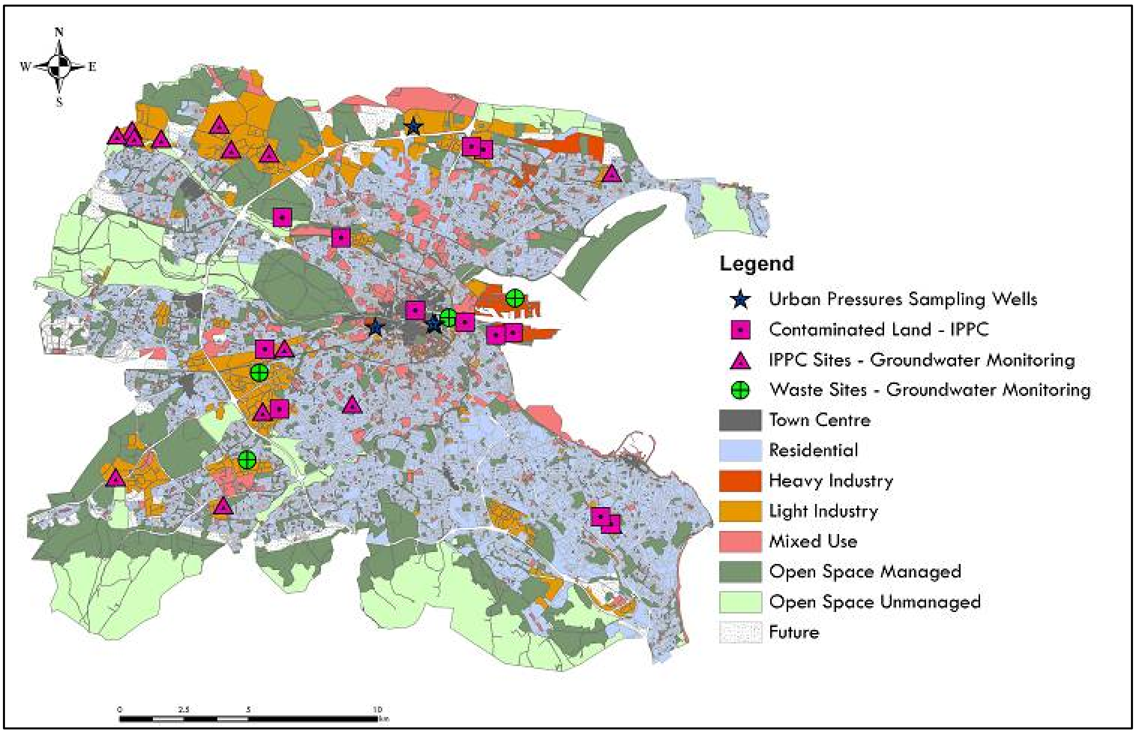

Figure 12: Facilities Included in the Groundwater Quality Assessment of the Dublin GWB

The data in **Table 20** for Dublin represents water quality in the Calp limestone only. It does not reflect groundwater quality in the glacial till which overlies the limestones across Dublin or the sand and gravel aquifer that overlies the till in city centre and Dublin harbour.

The sand and gravel aquifer in particular is known to be polluted by sewage compounds. A study on the hydrogeology of central Dublin was recently carried out by Queen's University Belfast (QUB, 2006). The study explored the geology, groundwater vulnerability and groundwater chemistry in the city centre and ports area. It included the collation of datasets from a variety of sources, including the EPA, GSI, DCC, and private developers representing past research, site investigations and environmental impact statements. In terms of groundwater quality, results from 102 "chemical points" were spatially analysed using GIS tools, the data reflecting a variety of physical settings and land uses (including contaminated land sites). Data from the following locations were used: Hammond's Lane, Sir John Rogerson's Quay, East Point Business Park, Dawson Lane, Barrow Street, Fairview, Fitzwilliams Street, Trinity College Dublin, Custom House Docks, and George's Quay.

From the available data, saline groundwater is reported close to the Liffey, Sandymount and Dublin harbour. Overall, (shallow) water quality in the sand and gravel deposits was judged to be poor, with contamination by trace inorganic, organic and major ion species. The organic pollutants were mostly linked to past contaminated land sites (e.g., Hammond's Lane near Ringsend). As reported by QUB, there were numerous instances where concentrations of inorganic species (including indicator determinands of sewage) exceeded the "maximum allowable concentrations in drinking water" (referring to EC DWSs). Elevated concentrations of several metals (Co, Zn, Ni, Cd, and Pb) at different locations are reported to be correlated to past land uses (contaminated land sites). Besides being saline, one bedrock well (i.e., beneath the glacial till) at the proposed Dublin Waste-to-Energy facility near Ringsend (DCC, 2005) showed low concentrations of MTBE as well as aliphatic and aromatic hydrocarbon compounds.

While sewer exfiltration was not conclusively proven by the QUB study, there were numerous indicators of sewage in shallow groundwater such as ammonium, nitrite, phosphorus, and boron. Microbiological parameters were not included in the analyses, and the study recommended that pathogens (and nitrogen isotopes) be included in future work.

As part of the groundwater sampling programme carried out for this FC study, two monitoring wells in the shallow sand and gravel aquifer were sampled at Trinity College. Results (Appendix D) strongly suggest sewage-impact as indicated by *E. Coli*, ammonium, nitrate (above DWS) and nitrite.

Soil and shallow groundwater was recently sampled along a 0.5 km wide strip of the proposed Metro North route between Belinstown and St. Stephen's Green (RPA, 2008). While the sampling was limited in extent, it does offer a snapshot of soil and groundwater quality along a shallow geological cross-section of Dublin.

Soils:

Per the Metro North EIS, soil sample results were compared to Soil Guideline Values (SGV) for commercial and residential properties (the latter with consumption of home grown vegetables).

The concentrations for all determinands for all samples were reportedly below the assessment criteria for commercial properties. Some parameters did breach the assessment criteria for residential properties, as follows:

- Metals: Cadmium and Nickel were elevated above their respective assessment criteria in "a large percentage of the samples analysed". Arsenic was elevated above its assessment criterion at seven locations. Whether or not these exceedances reflect urban pressures or naturally occurring levels in soils have not been conclusively determined.

- Hydrocarbons: The aromatic hydrocarbon chain C^{12}-C^{16} was elevated above assessment criteria at 12 sampling locations.

- The PAH Benzo(a)pyrene was elevated above its assessment criteria at 6 sampling locations. Five of locations were also elevated for the aromatic hydrocarbon chain C^{12}-C^{16}. PAHs are indicative of fuel contamination such as diesel, heating oil, lighting/oil stove or coal fuels.

- The volatile organic compounds bromochloromethane and dichloromethane were elevated above their respective assessment criteria at one location only each. These would be indicative of solvent use.

- Naphthalene, a semi-volatile organic compound, was elevated above its assessment criterion at one location only.

The original soil data have been requested from the RPA but not yet received, hence the specific locations of the elevated concentrations are not known.

Groundwater:

Per the Metro North EIS, groundwater sample results were compared to EPA's Interim Guidance Values for ground water (EPA, 2003). Nearly all of the samples collected are believed to represent shallow groundwater from the subsoils (mainly glacial till) which cover the Dublin region and which overlie the Dublin limestone GWB. In the city centre, some samples were collected from the shallow sands and gravels which overlie the till. Few of the samples are believed to reflect groundwater quality the "Calp" limestone which forms the Dublin urban GWB.

The groundwater samples collected were analysed for a range of parameters, including metals, pesticides, SVOCs (including PAH and phenols), TPH, VOCs, alcohols, glycols inorganics, PCBs, acids/bases, alkalinity, bacteriological contamination and organics. Results indicate that shallow groundwater is mostly free from contamination (below detection limits or at low concentrations) but that elevated concentrations of certain compounds above IGVs do occur, for example ammonium, nitrite, sulphate, zinc, lead, TPH, and the insecticide malathion. Additional elevated detections of IGVs are referenced for chromium, nickel, as well as total coliforms.

The original groundwater data have been requested from the RPA but not yet received, hence the specific locations and circumstances of the elevated concentrations are not known. Nonetheless, the presence of elevated concentrations of TPH, PAHs and certain metals in both soils and shallow groundwater is indicative of urban impact, although care must be taken when assessing metal detections as they can also occur naturally.

The consistently detected pesticide malathion (an organophosphate insecticide) is unexpected. Malathion was not identified as a pesticide of particular concern in the recent study on pesticide risk to groundwater in Ireland (CDM, 2008b). The Pesticides 2007 book published by the Pesticide Control Service (PCS) of the Department of Agriculture, Fisheries and Food (DAFF) indicates that Malathion is sold in Ireland under the product names Greenfingers Malathion, Malathion,

Malathion 57%, and Malathion 60. Malathion is used for pest control; however, malathion does not appear as a commonly used insecticide in the arable crop sector in Ireland (CDM, 2008b). It is a volatile and non-persistent pesticide in the subsurface (groundwater) environment, with a low leachability factor from soils. It is therefore expected that the use of malathion in the Dublin area must be recent, and possibly related to recreational landscaping. According to the US Environmental Protection Agency, it is the most commonly used insecticide in the US, where it is used for control of boll weevils, for mosquito control, and lawncare.

4.2.2.2 Waterford

Figure 13 shows the locations of wells or facilities for which data have been used.

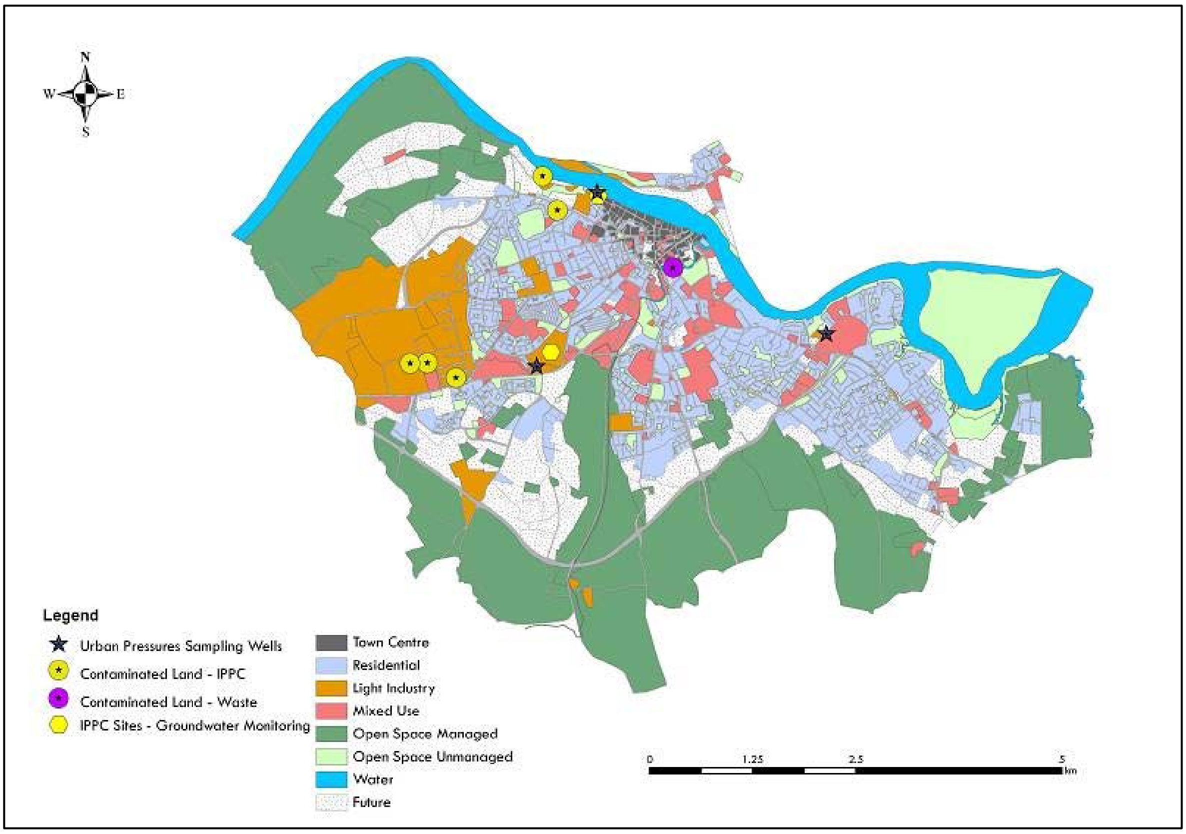

Figure 13: Facilities Included in the Groundwater Quality Assessment of the Waterford GWB

The associated area-weighted average concentrations presented in **Table 19** exceed EPA's water quality thresholds for *E. Coli*, total coliforms, ammonium, manganese, benzene and the sum of trichloroethylene and tetrachloroethylene.

The urban footprint of Waterford includes six contaminated land sites, two former landfills, and the Waterford gasworks site.

The Waterford industrial estate comprises five facilities that are presently under investigation for groundwater contamination. Remediation is ongoing at one site but still required at the others. The contamination includes VOCs, hydrocarbons and metals. One of the sites involves contaminants that are not included in the list of analytes for which DWSs exist; 1,1,1-trichloroethane and trichlorfluoromethane (TCFM) at concentrations up to 100 µg/L in 2007. Particularly elevated zinc concentrations are also associated with two facilities.

The full extent of groundwater contamination in Waterford is not known and is not possible to delineate with the current database. Additional monitoring outside of the industrial estate is warranted. A private abstraction well that is located in a downgradient location of the urban footprint and adjacent to the River Suir was sampled as part of this FC study. The well is located more than 3 km from the industrial estate, yet several VOCs were detected at low concentrations (<5 µg/L) and confirmed in four rounds of sampling. Unconfirmed detections of two herbicides, atrazine and simazine, are also noted in this well. The same well also shows detections of *E. Coli* and total coliforms and elevated concentrations of copper and nickel.

4.2.2.3 Swords

The urban footprint of Swords includes three IPPC facilities, of which two are designated by the EPA as contaminated land sites. One facility in particular is associated with groundwater contamination of petroleum-related compounds as well as tetrahydrafuran, ammonium and pesticides (dichlobenil).

Both sites are subject to remediation and associated monitoring, and one site is subject to additional investigation of plume migration offsite. Given the ongoing work at both sites, the FC study on contaminated land sites (ShRBD, 2008) has concluded that neither site poses a particular risk of the related GWB not meeting WFD objectives by year 2015.

4.2.3 Public and Private Supply Wells

Three public supply wells are present along the urban margins of Drogheda (two wells) and Portlaoise (one well). Two herbicides, atrazine and simazine, were detected in one of the wells in Drogheda. Simazine was detected marginally above its DWS, and the detection was unconfirmed in a subsequent round of sampling. *E. Coli* (unconfirmed) and total coliforms (confirmed) were also detected in the Drogheda well.

In samples collected by the EPA in 2007, the herbicides MCPA and mecoprop were detected below their 0.1 µg/L DWS in Portlaoise. In Drogheda, detections of atrazine and MCPA were confirmed in two successive rounds of sampling, and MCPA exceeded its DWS (0.1 µg/L) on one occasion at 3.3 µg/L. Given the peri-urban locations of these wells, the herbicides could be the result of agricultural practices rather than urban pressures.

As part of EPA's pre-WFD monitoring, 5 industrial abstraction wells were sampled regularly between 1996 and 2006 in Drogheda, Tralee, Kilkenny, Portlaoise, and Carlow. With the exception of one well in Drogheda, none of the wells shows obvious signs of urban pollution. The well in Drogheda showed the presence of volatile organic compounds (1,1,1-TCA at 16 µg/L) in a single sample in 2004.

4.3 Implications for Groundwater Status Classification

Per WFD requirements, the EPA is presently classifying the status of all water bodies across Ireland, including groundwater. Basic WFD status objectives are:

- All water bodies must achieve at least "good" status by year 2015;
- Status deterioration from one status category to another must be prevented (between successive 6-year river basin management cycles);
- Environmental quality objectives (EQOs) must be achieved for drinking water protected areas.

The GWBs that are classified by the EPA as being of "less than good status" (LTG) from urban pressures will require mitigation measures as described in Section 5.

Status is assigned on the basis of a set of classification "tests" which are based on comparisons between monitoring data and EQOs. For groundwater, the specific classification tests are defined in the UK TAG guidance document titled "Groundwater Chemical Classification for the Purposes of the Water Framework Directive" (UKTAG, 2007). The tests relate to four specific water quality issues:

- Impacts from saline intrusion;
- General water quality of a GWB;
- Impacts on GWDTEs;
- Impacts on drinking water protected areas.

Several of the status classification tests use data to both calculate statistical values over defined time periods and to identify trends. Others are simply based on impact at a specific monitoring point.

4.3.1 Saline Intrusion

The Dublin GWB is known to be locally impacted by seawater. Localised intrusion has been identified along the tidal section of the Liffey and the harbour area (QUB, 2006; DCC, 2005), and saline groundwater was encountered during the excavations of the Port Tunnel.

Groundwater beneath Cork city is also influenced by seawater (Allen, 2007). However, this influence affects the sand and gravel aquifer which is not a formally assigned GWB for WFD reporting purposes.

In both cases, the localised saline impacts in Dublin and Cork would be exempt from WFD poor status classification, as they are of a natural origin. While equivalent data do not exist for other urban areas, similar scenarios are expected for other coastal towns, particularly where aquifers are karstic. In the west of Ireland, seawater is known to impact springs several kilometres inland as a result of natural tides (CDM, 2009).

4.3.2 General Groundwater Quality

Per the UKTAG on status classification (UKTAG, 2007), "good chemical status [in a GWB] is not met when the EC DWS is exceeded at monitoring points, and a representative aggregation of the data at the GWB scale indicates a significant environmental risk or a significant impairment of human uses". The classification test is carried out for determinands for which drinking water standards apply, or for which the risk characterisation process has indicated a risk of significant impairment of human uses.

"Representative aggregations of data" can only be developed for Dublin, Waterford, and Swords, per Section 4.2.2. On the basis of the UKTAG methodology and the results of **Table 20**, both Dublin and Waterford could be considered as candidates for LTG status classification. However, on respective GWB scales, broader contamination issues are apparent in Waterford.

Any designation of LTG status would imply that programmes of measures may be necessary to achieve good status objectives by 2015. However, active monitoring and remediation is taking place at several of the facilities that are known to cause localised problems, and this should be taken into consideration when assigning qualitative (chemical) status (i.e., by actively pursuing a programme of remediation for each impacting facility).

Groundwater quality impact has been identified in the shallow sand and gravel deposits in central Dublin. However, this shallow impact is not subject to status classification by the EPA since this aquifer does not constitute a formal GWB, and it is also unlikely to be considered as a potential resource for future human use. Nonetheless, the fact that polluted, shallow groundwater discharges to the Liffey and Dublin Bay implies that its influence on the receiving waters should be considered as part of any future programmes of measures.

The status classification tests are data intensive by nature, and the current groundwater quality database is insufficient to assess qualitative (chemical) status for all urban GWBs objectively (in the manner presented in **Table 20**). Nonetheless, available data indicate the presence of urban groundwater pollutants in some the higher-risk urban GWBs. Additional monitoring is needed to verify their presence and the extents of such pollution.

As a check on potential impacts to surface water receptors, the EPA's status classification of rivers and estuaries have been reviewed for all of the urban areas included in this POMs study. Several rivers have been classified as LTG in segments that run through the urban areas. However, none of the cases are linked or referenced to groundwater as the cause of the LTG status designations. Instead, LTG status designations tend to be attributed to direct wastewater discharges and morphological pressures. The same is true for estuaries.

All urban GWBs remain at risk of groundwater pollution, and therefore at risk of not meeting WFD status objectives in 2015. However, it cannot be concluded that all urban GWBs are, or can be inferred to be, impacted to the extent that GWB-wide exceedances of DWSs would occur. New and additional groundwater monitoring data are recommended to complete the assessment of qualitative (chemical) status in all higher-risk urban areas.

4.3.3 Groundwater Dependent Terrestrial Ecosystems

While numerous GWDTEs across the country are considered to be at risk of not meeting WFD status objectives by 2015 (NPWS, 2008), only three GWDTEs are directly associated with urban footprints; Maynooth/Leixlip, Galway, and Sligo. The environmental supporting conditions that sustain GWDTEs are not well understood and will be subject to future study and monitoring by the NPWS.

4.3.4 Drinking Water Protected Areas

Per the UKTAG methodology for status classification, "conditions for good chemical status are not met when there is a significant and sustained rising trend in a key parameter at the point of abstraction and the threshold value is exceeded". The classification test is applied at the point of abstraction of "water intended for human consumption".

As described in Section 4.2, few parameters were detected above the DWSs in the period for which data are available. Given the marginal urban locations of the Portlaoise and Drogheda public supply wells, and the fact that their zones of contribution extend beyond urban footprints into agricultural lands, the source of the exceedances cannot definitively be attributed to urban pressures.

4.4 Implications for Groundwater Monitoring

4.4.1 Priority Areas

Monitoring of groundwater in all of the higher risk urban areas is recommended for WFD purposes. The weight of evidence suggests that groundwater in all town centres is at risk of pollution although the risk is reduced if the GWB in question is overlain by low-permeability soils and subsoils. The latter is especially true for towns in the eastern part of Ireland, including Dublin. Actual impacts to groundwater will therefore vary as a function of site-specific hydrogeology and pathway factors.

Known point sources of pollution are presently being monitored by the EPA, or are under active remediation. Potential pollution sources such as leaking underground storage tanks are also controlled through construction codes, leak tests, and in some cases point-specific monitoring. The potential sources of urban pollution that are deemed to be at highest risk of escaping existing enforcement schemes are leaking sewers and urban runoff, as well as accidental or deliberate spills of chemicals and waste materials.

Groundwater monitoring in the highest risk urban areas is especially recommended where groundwater is a potential resource for human use. This would exclude most towns or cities that are underlain by poorly productive aquifers. Dublin may be the exception, simply based on its size, variety of potential pollution sources, and potential use as a source of public water in the future.

In terms of priorities, it could be argued that there is reduced value to monitoring groundwater in town centres unless consumptive use of groundwater is involved or receiving groundwater is suspected of being a leading cause of poor ecological status classifications of surface waters. No such cases have been identified as part of the urban pressure study.

The primary problem expected in town centres is sewage. Monitoring groundwater from sewage leaks is a near-impossible task, as the locations of leaks are not known unless detailed CCTV surveys are carried out and verified with excavation activities. This is a costly and disruptive activity, and more importantly, if a leak is detected, it should be fixed, thus reducing the need for location-specific groundwater monitoring.

Representative monitoring of groundwater in city centres is also difficult to accomplish, partly due to limitations with finding suitable locations for monitoring, and partly the costs associated with the construction of dedicated long-term monitoring wells (which includes setting aside land or installing purpose-built protective structures).

It is proposed that future monitoring be prioritised in LTG status GWBs and vulnerable, higher-risk GWBs which can be used for water supply or that are associated with important ecological receptors such as GWDTEs.

The monitoring should tie into an understanding of land use impacts as land use activity influences runoff volumes and recharge. The change in land use that takes place from the process of urbanisation is important in the WFD context.

Little is known about the process of urbanisation in outlying areas, and it therefore proposed that initial monitoring efforts target two types of land uses:

- Rapidly expanding urban areas (i.e., areas undergoing rapid hydrological changes and with added traffic and commercial activities);

- Established high-density residential and commercial land uses.

High-density residential and commercial land uses make up the largest areas within urban footprints. They incorporate amenity spaces (parks, golf courses) and industrial estates. Population density has been directly correlated to pollution of shallow groundwater resources elsewhere in the world (e.g., Eckhardt and Stackelberg, 1995). In the US, statistically significant correlations have been reported between groundwater pollutants and residential and commercial land uses (Robinson, 2002).

The areas encompassing high-density residential and commercial land uses are also where most of the identified industrial wells are located and where future (industrial/private) wells in urban areas will likely be drilled. There are three specific situations that most water supply entities and regulators will face as urban areas grow:

- Existing water supply sources (e.g., wells) lie at the edge of an urban area, within the "path" of expanding development;

- New development encroaches on the upgradient recharge area of the wells;
- The zone of contribution of a particular well extends into the urban footprint of a town/city.

Land-use based monitoring of growing urban areas will therefore provide insights into processes and timescales of potential water quality degradation and how to better plan for new developments in the future.

Groundwater in city centres is not expected to be used except for certain industrial needs and geothermal applications such as those presently installed in Cork and Dublin.

Monitoring of changing urban areas would also provide information to planners and regulatory agencies as to how developments and popular measures such as SuDS or Low Impact Development (LID) schemes may affect groundwater quality. The WFD requires trend observations and reversal of trends as a criterion to promote good status of GWBs.

4.4.2 Approach

Monitoring should incorporate existing abstraction wells and may require the construction of new monitoring wells in any given urban area.

Abstraction wells obtain water from larger zones of contribution, both horizontally and vertically, and therefore provide useful measures of diffuse pollution problems. Incorporating existing abstraction wells may first require a survey of wells and then obtaining necessary permissions from well owners. The wells would have to satisfy physical integrity criteria similar to those developed for screening of monitoring points during the design of EPA's national groundwater quality monitoring network (EPA, 2006).

Depth-specific sampling in nested wells may also be needed, depending on the hydrogeological scenarios involved. Cronin et al. (2005) highlight studies in the UK where regional abstraction wells would detect urban contamination at low concentrations, whereas depth-specific sampling from nested wells revealed a clearer pattern of urban contamination where different types of sources could be attributed. Existing abstraction wells, if appropriately located and screened, could therefore serve to screen or inform about potential water quality problems, followed then by nested well installations to improve the understanding of the vertical distribution of pollution. Given the heterogeneities inherent in Irish aquifers, this would appear to be an especially appropriate approach.

In addition to groundwater quality monitoring, groundwater level monitoring should also be carried out in select cities or towns. As an example, urban development in cities such as Dublin and Galway has soared under the construction boom over the past 10-15 years, which in turn has led to substantial increases of real estate prices. As a result, urban development is expanding vertically, which includes the use of subsurface space (e.g., parking houses). Water level monitoring would be recommended in new development areas where significant land uses changes take place and where local hydrology is being impacted by impervious covers and deep construction. There is presently no network of wells for routine water level monitoring in any town in Ireland.

5. Programmes of Measures

Programmes of Measures (POMs) are mitigation measures that may be required by EU Member States to ensure that WFD status objectives are met in all water bodies, including groundwater, by 2015. POMs are incorporated into River Basin Management Plans (RBMPs) which have to be submitted to the EC in June, 2009. Draft RBMPs were prepared for each RBD in Ireland in December 2008 and will be available for a six-month public review period.

POMs are intended to address specific requirements of the WFD and significant water management issues that have been identified to date in both the Initial and Further Characterisation phases of WFD implementation. POMs will be revised by competent authorities every six years following a review of monitoring data being generated in the intervening period, as well as a re-assessment of environmental pressures. Thus, revised RBMPs will be submitted to the EC in six-year cycles.

5.1 WFD Status Objectives

Basic WFD status objectives are as follows:

- Achievement of at least "good" status for all water bodies by 2015;
- Prevention of status deterioration from one status category to another in successive six-year RBMP cycles;
- Achievement of environmental quality objectives (EQOs) for drinking water protected areas.

The EPA has prepared an interim status classification of all GWBs nationally, partly with input from this urban pressures assessment. The classification will determine where measures will be targeted. Any urban GWB that is classified as being at less than good (LTG) status will require mitigation measures. Measures are basically of two types:

- Basic measures – covered under existing statutory instruments (laws and regulations);
- Supplementary measures – new recommended measures that could be voluntary or made statutory. They could take the form of codes of good practice, bye-laws, or one-off actions (e.g., surveys and research).

The financial and political costs of returning a LTG status GWB to good status are likely to be significant. The types of mitigation measures that could be needed are: (1) upgrading of infrastructure (e.g., sewers); (2) placing constraints on infrastructure design and construction; (3) improved controls on drainage from impermeable surfaces; (4) restricting development; (5) imposing new environmental or water resources management legislation; and (6) setting stricter controls on (and monitoring of) commercial and industrial activities.

For this reason, pollution prevention is arguably the most important aspect of POMs. An overall goal of the POMs should therefore be to elevate the general awareness and knowledge of groundwater resources and its linkage to land use activities and infrastructure.

5.2 Existing Basic Measures

There are numerous applicable Basic Measures (BM) that are covered by Irish Statutory Instruments (SI) and legislation, as summarised in **Table 21**. Existing legislation incorporates a wider range of measures that address everything from prevention of chemical spills to broader ecological conservation goals.

Under existing legislation, the EPA has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection. In the urban context, this relates mainly to:

- IPPC licences
- Waste licences
- Urban wastewater licences

The EPA has been licensing certain large-scale industrial and agricultural activities since 1994. Industrial licensing was originally known as Integrated Pollution Control (IPC) licensing and governed by the Environmental Protection Agency Act, 1992. This Act was amended in 2003 by the Protection of the Environment Act, 2003 which gave effect to waste licensing and the IPPC Directive. IPPC and waste licences aim to prevent or reduce emissions to all environmental media, including groundwater.

In theory, if fully (100%) implemented, the existing statutory instruments should be sufficient to manage and eliminate most, if not all, types of point sources of pollution. In practice, this is difficult to achieve due to occasional spills and poor handling and management practices of waste and dangerous substances. While laws exist and EPA enforces laws through an environmental auditing process, point sources are known to have caused groundwater quality deterioration as described in Section 4.

Even with pollution prevention laws, it is impossible to safeguard against all types of urban pollution sources, notably diffuse sources such as pesticide leaching or infiltration of road runoff. There are numerous published best management practices (BMPs) that address diffuse sources of pollution and that can be implemented (or enacted) further as pollution prevention measures. Important BMP references are:

- EPA – Best Available Technology (BAT) guidance notes (available from www.epa.ie)
- Environment Agency, Scottish Environment Protection Agency, Northern Ireland Environment and Heritage Service (2005) – General Guides to the Prevention of Pollution;
- US Environmental Protection Agency (2005) - National Management Measures to Control Non-point Source Pollution from Urban Areas;

Table 21: Existing Basic Measures

Irish Legislation	Corresponding EU Directive
SI 722 European Communities (Water Policy) Regulations 2003	Water Framework Directive (2000/60/EC)
11 Basic Directives	
S.I. 41 of 1999 Protection of Groundwater Regulations, 1999 (to be revoked 22/12/2013)	The Groundwater Directive (80/68/EEC) (To be revoked 22/12/2013)
S.I. 278 of 2007 EC (Drinking water Regulations) (No 2)	The Drinking Water Directive (98/83/EC) (80/778/EEC repealed 25/12/2003)
S.I. 74 of 2006 EC (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2006	The Major Accidents (Seveso) Directive (96/82/EC) extended by Directive 2003/105/EC
S.I. 349 of 1989 EC (Environmental Impact Assessment Regulations) 1989 and amendments	The Environmental Impact Assessment Directive (85/337/EEC) as amended by Directive 97/11/EC
S.I. 148 of 1998 Waste Management (Use of Sewage Sludge in Agriculture) Regulations, 1998 - 2001	The Sewage Sludge Directive (86/278/EEC)
S.I. 254 of 2001 Urban Waste Water Treatment Regulations, 2001 and 2004	The Urban Wastewater Treatment Directive (91/271/EEC)
S.I. 624 of 2001 EC (Classification Packaging and Labelling of Plant Protection Products and Biocide Products) Regulations, 2001. S.I. 83 of 2003 EC (Authorisation, Placing on the market, use and control of Plant Protection Products) Regulations, 2003 and amendments. S.I. 320 of 1981 EC (Prohibition of certain active substances in plant protection products).	The Plant Protection Products Directive (91/414/EEC)
S.I. 378 of 2006 EC Good Agricultural Practice for Protection of Waters Regulations, 2006 - 2007	The Nitrates Directive (91/676/EEC)
S.I. 94 of 1997 EC (Natural Habitats) Regulations, 1997 - 2005	The Habitats Directive (92/43/EEC)
S.I. 85 of 1994 EPA (Licensing) Regulations, 1994 & 2004	The Integrated Pollution Prevention Control Directive (96/61/EC)
S.I. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007.	
S.I. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007. Water Services Act 2007. S.I. 12 of 2001 Water Quality Dangerous Substances Regulations, 2001. Local Government (Water Pollution) Act, 1977 and amendments (Section 4 and 16)	The Dangerous Substances Directive (2006/11/EC) (76/464/EEC Repealed) and Daughter Directives
Planning and Development Regulations 2001 - 2007 (S.I. 436 of 2004)	Strategic Environmental Assessment Directive (2001/42/EC)
EU Regulations Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) (1907/2006/EC)	Dangerous Substances
Other Relevant Items	**Corresponding Irish Legislation**
Measures to apply the principle of recovery of costs of water use	National Water Pricing Policy Framework (1998)
To promote efficient and sustainable water use	National Water Pricing Policy Framework (1998)
To safeguard water quality in order to reduce the purification treatment required for drinking water.	
Controls over the abstraction and impoundment of groundwater.	Planning and Development Acts 2000-2006. Water Supplies Act 1942 Licensing system (in progress)
Control, including a requirement for prior authorisation	

Irish Legislation	Corresponding EU Directive
of artificial recharge or augmentation of groundwater bodies	
Control of point source discharges	EPA Regulations 1992 - 2003 and associated licensing regulations. Water Pollution Act.
Control of diffuse source of pollution	Water Services Act 2007. SI 378 of 2006 Good Agricultural Practice for Protection of Water Regulations, 2006.
Authorisation of direct pollution discharge into groundwater	SI 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007. SI 41 of 1999 Protection of groundwater regulation.
Elimination of groundwater pollution by priority substance and to progressively reduce pollution by other substances.	Various pollution prevention BATs and BMPs
Regulations to prevent and reduce the impacts of accidentals pollution incident	SI 74 of 2006 Control of Major Accident Hazards Involving Dangerous Substances. Framework for Major Emergency Management, Office of Emergency Planning, 2006.

- CIRIA (2007) - The SUDS Manual (C697);
- CIRIA (2001) - Control of water pollution from construction sites (C532);
- CIRIA (1996) – Reliability of Sewers in Environmentally Vulnerable Areas (C44);
- SuDS Evaluation Tool – at www.irishsuds.com

Groundwater protection is implied if not specifically addressed in BMPs such as Sustainable Urban Drainage Systems (SuDS). SuDS have become increasingly important in recent years and are now frequently incorporated into land development schemes around the country.

It is not the intent of this report to reproduce the wealth of literature that exists on BMPs for urban pollution prevention. Instead, supplementary measures described in the following sections address particular data and information gaps that have come to light during this FC study, and which could result in improved environmental controls. The following sections also provide suggestions as to how such data might be better captured to enhance the understanding of urban groundwater pressures and impacts.

5.3 Proposed Supplementary Measures

While only the Waterford GWB can be said with the available data to be impacted over a wider area, groundwaters in all urban areas are at risk of pollution, and all urban areas should be subject to pollution prevention measures. To this effect, expanded and routine groundwater quality monitoring is recommended focussing on higher risk towns and cities as a first step. Monitoring in itself can be regarded as a supplementary measure, and it is proposed that supplementary measures also focus on opportunities (actions) to improve the collective knowledge about urban pressures, pathways and receptors. The proposed supplementary measures are summarised in **Table 22**, and are arranged according to four categories:

- Source (Pressure) Information;
- Pathway Information;
- Receptor Information;
- Other.

The means by which supplementary measures might be implemented are also identified, and fall into these broad classes:

- Surveys, mapping, and research;
- Codes of best practice or legislation;
- Groundwater quality monitoring;
- Improved infrastructure;
- Planning.

5.3.1 Source (Pressure) Information

Considerable effort has been spent in this FC study to research available pressure information. Significant gaps exist in the quantitative knowledge of pollutant loading, particularly that associated with diffuse pressures. The accompanying FC study on urban surface waters was helpful in quantifying stormwater runoff. Still, in the main, future surveys are needed to quantify and address:

- Patterns and event mean concentrations of compounds associated with urban runoff (e.g., PAHs, metals);
- Impact of urban runoff on groundwater quality, focussing on extremely vulnerable settings;
- Pesticide usage in the urban setting, focussing on maintenance of amenity spaces, industrial facilities, and transportation sectors;
- Sewage system characteristics in relation to exfiltration potential.

The recommended measures associated with quantifying patterns and event mean concentrations in Irish towns are elaborated upon in the accompanying urban surface water study (CDM, 2008a). The other recommended surveys are described below.

Table 22: Proposed Supplementary Measures

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Source Factors			
Urban land use	Consistent classification scheme	• Standardise the procedures for the preparation and reporting of development plans; • Introduce standardised land use/zoning classification methodologies.	• Guidance
Transportation infrastructure	Access to GIS information and layers	• OSI agreements	• Modification to CCMA
Sewers	Asset management information	• Detailed mapping of sewage infrastructure – diameters, layouts; • Adopting and implementing the infiltration/exfiltration policies of the GDSDS (2005a); • Greater use of information management & and information management systems integration.	• GIS mapping; • IMS development and integration with GIS; • Code of Practice (GIS)
Sewers	Construction depths/levels	• Recording and reporting of completed new sewer details – diameters, depth profiles.	• GIS mapping; • Code of Practice (GIS)
Sewers	Leaks (locations, nature)	• Recording and reporting of leaks and overflow incidents.	• GIS mapping; • Code of Practice (GIS)
Sewers	Extent of misconnections	• Survey of misconnections.	• Survey; • GIS mapping
Sewers	Exfiltration potential	• Development of exfiltration susceptibility maps.	• Surveys; • Mapping;
Sewers	Quality control (integrity)	• Prioritised supervision of construction; • Design provisions in groundwater vulnerable areas.	• Provision of adequate resources for local authorities; • Code of Practice (Design)
Industrial effluents	Discharge to sewer locations and volumes – volumes, water quality	• Mapping of industrial effluent.	• GIS mapping; • Code of Practice (GIS)
Underground storage tanks	Locations, volumes	• Registration of USTs.	• Registration; • GIS mapping

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Pesticide use	Statistics of usage in domestic, amenity, and transport sectors	• Survey of pesticide sales and use.	• Survey; • Legislation – records of sale; • Legislation – summaries of usage
Saline intrusion	Cases, extent	• Restrict abstraction and long-term dewatering schemes in coastal zones.	• Abstraction licensing
Pathway Factors			
Groundwater vulnerability	Groundwater vulnerability mapping	• Continued financial support for GSI's ongoing mapping programmes; • Expand GSI mapping to urban areas; • Recording and reporting of vulnerability factors to the GSI by local authorities, geotechnical companies, consulting firms and/or developers.	• Funding for GSI mapping; • Code of Practice/implementing GSI Bill – submittal of information to the GSI
Preferential pathways	Well construction practices	• Ensure proper well construction with grouting seals; • Decommission abandoned wells that are no longer used and which are improperly constructed.	• Surveys of existing wells; • Decommissioning of relevant wells; • Enforcement of well construction practices
Receptor Factors			
Ecological receptors	Detailed mapping of GWDTEs and definition of supporting conditions	• Ecological and hydrogeological surveying.	• Surveys; Monitoring
Ryewater SAC	Possible urban hydrological influence on the Ryewater GWDTE	• Hydrological study of environmental supporting conditions, and ecological status of the GWDTE.	• Survey; • Monitoring
Public supply wells	Zones of Contribution and Source Protection Zones	• Establish Source Protection Zones with expanded requirements for monitoring.	• Surveys; • Monitoring
Private abstraction wells	Locations, construction details, abstraction volumes	• Mapping and registration.	• Survey; • Licensing
Water use	Degree of urban groundwater use in the foods industry	• Survey of foods industry; • Establish Source Protection Areas.	• Survey; • Expanded monitoring

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Other			
IPPC and Waste licensed facilities	Monitoring wells	• Mapping and coding of wells.	• Survey; • Mapping; • Code of Practice (Facility reporting)
Groundwater quality data capture	Lack of consistency in reporting of water quality	• Minimum submittal requirements to EPA; • Standardise formatting of reporting; • Standardise detection limits to DWS and EQO requirements.	• Code of Practice (facility reporting); • License stipulations
Groundwater quality data capture	Data review and assessment	• Directly link data submittals to EPA's EDEN database suite - applies to all data submitted for IPPC, waste, and contaminated land sites, and sources of water that are consumptively used.	• EDEN Integration Programme; • Code of Practice (new reporting structure and requirements for licensed facilities and local authorities)
Road Runoff	Impacts of road runoff on groundwater quality	• Quantify types and quality of runoff, and pollutant loading to groundwater at pilot test sites.	• Research
SuDS	Location, types	• Survey of existing large-scale SuDS schemes; • Registration of SuDS schemes.	• Survey and database development; • Policy; • Legislation
SuDS	Groundwater quality impact	• Groundwater impact study in vulnerable area.	• Research; • Potential new legislation
SuDS Planning and Design	Hydrogeological factors	• Support development of the SuDS Evaluation Tool by expanding hydrogeological criteria.	• Technical input
Leaking sewers	n/a	• Sewer rehabilitation	• Investment programmes
Protection of public groundwater supplies	n/a	• Avoid construction of potential pollution sources within Source Protection Areas; • Introduce reinforced sewer construction practices within groundwater vulnerable zones.	• Code of Practice or Legislation; • Response matrices for construction of new sewers (see below)
Leaking water mains	n/a	• Leak reduction programmes; • Water conservation measures.	• Surveys; • Investment programmes

Item	Data/Information Needs	Proposed Measure	Means of Implementation
Planning and land use zoning	Groundwater awareness in urban areas	• Training programmes for local authority planners; • Restrict development or set conditions for measures to protect groundwater resources in vulnerable areas (e.g., industry, high-density residential).	• Training; • Planning guidelines; • Public awareness
Enforcement	Enforcement of license conditions	• Stricter enforcement.	• Provide adequate resources for EPA
Protection of urban groundwater resources	Lack of specific groundwater protection strategies in urban areas	• Develop groundwater protection strategies and measures.	• Development Plans; • River Basin Management plans
New sewer construction	Need to consider groundwater vulnerability in new sewer construction areas	• Develop groundwater protection response matrix, similar to work by GSI on landfills and septic systems.	• Response matrix of allowable construction and installation practices of new sewer networks

5.3.1.1 Impact of Urban Runoff on Groundwater Quality

The recent study by Bruen et al. (2006) demonstrated that road drainage features such as filter drains can be effective in removing metals from road runoff, but that inadequate construction practices and lack of maintenance increases the risk of pollution to receiving waters, including groundwater. Filter drains (and similar drainage features) are typically only constructed along larger national roads. While the study quantified road runoff characteristics and explored "treatment" effectiveness of constructed wetlands, it did not examine local impacts to groundwater.

There is no specific information on runoff impacts to groundwater quality in Ireland. Typical road runoff pollutants are suspended solids, heavy metals, and PAHs. All tend to be filtered by soil and subsoil media, as well as adsorbed to particulate matter in the subsurface environment. Nonetheless, road runoff impacts can be expected where groundwater vulnerability is extreme or high.

It is therefore proposed that such a study be carried out at a small number of test sites in representative urban settings. The study would have to quantify runoff quality, in situ measurement of concentrations in drainage systems, assessment of potential degradation rates, and pollutant mass balances above ground and at the groundwater table.

Criteria for selecting test sites should include: groundwater vulnerability (should be extreme) and road density and traffic volume (both should be high). Dedicated shallow monitoring wells would have to be installed and monitored over a sufficiently long period of time.

Such a study would provide very valuable insight into the basic questions or perceptions that arise about road runoff as a potential source of urban groundwater pollution.

5.3.1.2 Pesticide Usage in Urban Settings

A national assessment of risk to groundwater from pesticides was recently completed as part of WFD implementation in Ireland (CDM, 2008a). The study concluded that low-level pesticide detections can be expected where:

- groundwater vulnerability is extreme to high; and
- where pesticides are used that have higher intrinsic mobility characteristics in the subsurface environment.

The study also concluded that knowledge of pesticide use in urban settings is lacking. While some information exists on the types of pesticides purchased by local authorities and the general public in Dublin, corresponding information on applications and the quantities used do not.

It is therefore recommended that a survey of pesticide usage in urban areas be carried out. This would identify the types, quantities and locations of pesticide applications. Local authorities, larger infrastructure organisations (e.g., National Roads Authority; Dublin Airport Authority) as well as larger industries would be included in the survey. They should subsequently be asked to maintain records of purchase and use, and the latter may require the introduction of new legislation.

5.3.1.3 Sewer System Information and Performance

There are no statistics of exfiltration volumes in Ireland, but as stated in the GDSDS (GDSDS, 2005a), exfiltration almost certainly occurs. This is backed up by groundwater quality data collated as part of this FC study, which shows the presence of indicator compounds of sewage in many towns.

Policies and measures that are relevant to reduce or eliminate exfiltration potentials are extensively discussed in GDSDS (2005a) and CIRIA (1996). Long-term measures address the following topics:

- Data collection of sewer and ground conditions and placing these in a GIS format;
- Developing sewer models to evaluate sewer hydraulic performance;
- Expanding asset management programmes.

This study endorses the GDSDS policy ands measures recommendations. Specific measures that would assist in managing and reducing the risk of sewage pollution on of groundwater resources are:

- Capturing sewer system information in local authority GIS systems;
- Mapping groundwater vulnerability along new sewer transects during geotechnical surveys, using GSI vulnerability criteria;
- Prioritising construction supervision in groundwater vulnerable areas;
- Avoiding or making special design provisions for new sewer systems which run through designated groundwater protection zones.

The following types of sewer information should be entered (routinely) into local authority GIS systems:

- Sewer line diameters and elevations;
- Locations of known or suspected leaks;
- Locations of service laterals;
- Approximate groundwater level/elevation as observed during construction;
- Gravity sections and pressurised pipe sections.

Combined with topographic information and mapping of groundwater vulnerability, sewer asset information could be used to develop an “exfiltration susceptibility” map to highlight areas where risks from exfiltration would be high. Such information could then be linked to mapping of wells and ecological receptors in order to identify potential receptor issues and monitoring needs. The data and information generated would be particularly relevant in towns where groundwater is used for public or private water supply, or for other consumptive uses (e.g., food industry).

Regarding construction and maintenance of sewer networks, the constraints on local authorities to supervise new construction and development activities is well documented (GDSDS, 2005b). In terms of reducing risk of exfiltration, supervision should be prioritised for new installations and connection in areas that are deemed particularly susceptible to groundwater pollution. The emphasis would be to ensure that designs are adequate, that appropriate materials are used, and that pipe connections are completed properly.

New sewer lines should be avoided in susceptible areas if these intersect inner source protection zones (DELG/EPA/GSI, 1999) of existing or planned groundwater supply wells. If sewer trajectories through protection zones cannot be avoided, enhanced design and construction provisions should be included. It is recommended that a groundwater protection response matrix for new sewers be developed, in a manner and scope similar to those matrices that have been developed for landfills, landspreading, septic systems, outwintering pads, etc., as part of Groundwater Protection Schemes (GWPs) (DELG/EPA/GSI, 1999).

5.3.1.4 Land Use Classifications

Land use information contained in local area development plans was reviewed in the context of diffuse pressures. A survey of 12 development plans indicated that the development horizons and land use categories used by local authorities vary considerably, and a new set of urban land use maps was subsequently developed for the purposes of the urban POMs study.

To allow the information in local area development plans to serve as a common baseline, existing land use mapping had to be reclassified in order to be able to use the information across 33 urban areas in a consistent manner (CDM, 2008b). It was noted that land use maps, including boundaries of urban areas, were based on different standards and methods used by different local authorities. It is therefore proposed that a code of practice be developed for preparation of development plans by local authorities. Items to cover include:

- Methods for defining urban boundaries;
- Common planning cycles;
- Common GIS platform, information, and layer formats;
- Method for land use zoning;
- Methods for forecasting development.

5.3.1.5 Industrial Effluents

Industrial effluent discharges to sewer systems should be included in local authority GIS systems, along with reported or estimated quantities of discharge. Exfiltration from sewers carrying industrial wastewater would be of greater concern than sewers that do not. This would include both combined and separate foul sewer areas. Combined sewers are often shallower than separate sewers, older than separate sewers, and frequently installed with less resistant materials. All of these are all factors that can contribute to higher exfiltration rates.

5.3.1.6 Underground Storage Tanks

Locations of underground storage tanks (USTs) of chemical substances should be registered and entered into local authority GIS databases. The planning permission process for such facilities should include submittal of coordinates of the proposed UST, which could then be registered and entered into the GIS.

5.3.2 Pathway Information

5.3.2.1 Vulnerability Mapping

The vertical pathway risk factor is described by groundwater vulnerability, which is largely a function of subsoil thickness and permeability, as well as depth to groundwater in sand and gravel aquifers (DELG/EPA/GSI, 1999). Groundwater vulnerability (and related datasets) underpins much of the groundwater work associated with WFD implementation in Ireland.

The GSI has carried out vulnerability mapping across a majority of counties in Ireland and is continuing this work in unmapped areas under a four-year programme. At present, however, the resolution of mapping in many urban areas is low. This is partly because there was less relevant information for urban areas when the vulnerability mapping was undertaken, and partly because more focus has been placed on rural areas, since potentially polluting activities are occurring over a much wider area. Despite this, there are other means assessing groundwater vulnerability in urban areas. Geotechnical investigation work is being carried out daily in urban areas and the information is of great value to the GSI. Examples of developments where vulnerability-related information is collected include:

- Infrastructure developments, including sewer-line transects;
- Housing or commercial developments.

The GSI's mapping efforts greatly benefit from the geotechnical information collected. At the present time, the GSI receives information from industry and public bodies on a good-will basis; there are no statutory or systematic mechanisms in place to ensure that relevant information is relayed to the GSI. EIAs are good sources of data, and legislation could be enacted for this purpose (there is a Draft GSI Bill in preparation that has this intention).The importance of submitting information to the GSI that could be used in urban vulnerability mapping could also be reinforced with the help of professional organisations such as the IEI and IGI.

Given the importance assigned to vulnerability in all aspects of groundwater protection efforts, it is proposed that a code of practice be introduced whereby geotechnical investigation data are submitted to the GSI, at least for work carried out on behalf of local or regional authorities.

5.3.2.2 Well Construction Practices

Preferential pathways can be natural or man-made. The latter category includes improper well construction practices. An improperly constructed well is a well that allows surface pollutants to spread vertically to groundwater or allows shallow groundwater pollution to flow to deeper different aquifer units in the annular space between the casing and borehole wall. These risk factors are greater where well casing is not grouted in place, whereby the grout in the annular space prevents vertical movement of pollutants along the outside of the well.

Well construction practices are known to vary considerably depending on who drilled and constructed the well. There are dozens of well drillers around the country, using or applying a range of different drilling equipment and skill sets. The lack of grouting is a common phenomenon, but is not simply a function of well drillers, but also of those who design wells and prepare drilling contracts (e.g., consulting engineers).

The importance of grouting and sealing off surface pathways is described in well construction guidelines prepared for and published by the Institute of Geologists of Ireland (IGI, 2007). It is recommended that requirements for good well construction practice, including grouting, be upgraded as mandatory, at least as a code of practice and possibly as legislation. In the same manner, well drilling contractors should undergo a registration or certification programme that includes awareness and familiarity with good practice. The same applies to wells drilled in rural areas where nutrients in overland flow can find their way into groundwater locally around poorly constructed wells.

5.3.3 Receptor Information

Receptor factors relate to ecological needs and human users of groundwater.

5.3.3.1 Ecological Receptors

At this time, the NPWS has identified approximately 70 GWDTEs that are deemed to be at risk from environmental pressures across the country. Only three of these are located in proximity to the urban footprints included in this study. To ensure that GWDTEs are adequately protected, mapping efforts by the NPWS should receive continued support as WFD implementation is largely focussed on the ecological health of ecosystems.

In the urban context, more information is needed on the nature and degree of groundwater-dependency in each identified case. While GWTDEs have been identified on the basis of the presence of indicator wetland species, little information exists about their respective environmental supporting conditions, or their site-specific sensitivity to groundwater chemistry and flow/levels. Thus, each GWDTE should undergo hydrogeological study and monitoring. Such work should be scoped, coordinated, and implemented with the assistance of the NPWS.

5.3.3.2 Abstraction Wells

There are three public supply wells within the urban footprints studies. Zones of contribution and source protection areas should be defined for each, as a matter of priority. Available data suggest that groundwater quality from each well is good, but each well is located in rapidly expanding towns (Drogheda, Portlaoise). Source protection areas should be established and should be coordinated with the monitoring needs of the EPA. The GSI is presently undertaking source protection zoning for the Drybridge supply well, and this type of work should be expanded to all public drinking water supplies throughout the country.

More than 160 private/industrial wells were initially identified within the 33 urban areas. A survey conducted as part of this study confirmed the existence of 55 active wells. The majority are used for industrial processing but a few are also used in the foods industry.

The number of active abstraction wells in the 33 urban areas could be significantly higher than the 55 verified to date. The number of water wells drilled in the industrial and commercial sectors has risen exponentially in recent years, but there is presently no requirement to formally register or license such wells. Guidance towards a registration and licensing system for groundwater abstractions has recently been drafted for the DEHLG (CDM, 2008c). Planned legislation would include registration of all abstraction wells that pump more than 10 m^3/day, and (conditional) licensing for all that pump more than 250 m^3/day.

The planned registration and licensing system applies to future cases. Because there are known wells that consumptively use urban groundwater in the food processing industry, it is necessary and proposed that a targeted survey of the industry be carried out to identify the full extent of urban groundwater use. Subsequent registration of surveyed wells would apply retro-actively, and consideration should be given to impose source protection measures in each case, also retro-actively.

As new abstraction wells become known, details of wells should be captured in a centralised database and zones of contribution should be delineated using existing guidance (e.g., DELG/EPA/GSI, 1999).

Any urban wells found to abstract for food processing purposes may require additional supervision or water quality monitoring, involving an expanded sampling and monitoring regime.

5.3.4 Other

5.3.4.1 Groundwater Quality Data Capture

Groundwater quality data from multiple sources were reviewed for this study. The data were mainly sourced from EPA regional offices pertaining to IPPC and waste-licensed facilities, including contaminated land sites.

A review of the data indicates that data are reported in many different ways and formats, with different detection limits following different analytical methods. Sampling from one event to another also shows inconsistencies, for example, the list of determinands vary spatially and temporally on any given occasion for any given facility. Lack of consistency in reporting is a recurring theme. As a result, reporting compliance also varies in time and space.

The monitoring associated with IPPC and waste-licenses represents a potentially significant volume of data which could be a key resource to assess the future qualitative (chemical) status of urban GWBs across Ireland.

It is proposed that the current licensing system be reviewed in the context of WFD groundwater data needs. A dedicated network of monitoring wells in higher risk urban areas is needed, and licensed facilities would naturally be an integral part of that network.

Besides the lack of reporting consistency, monitoring data are presently reported and kept in hard copy format only. The nature of existing data sets is so varied that EPA's function of reviewing data in a broader WFD context (other than facility-specific compliance) is made extremely difficult.

It is therefore proposed that a code of practice be developed for consistent reporting of groundwater quality data to the EPA, whether the reporting originates from a licensed industry or a local authority. Entities that are required to report data to the EPA would essentially be required to submit data under new compliance stipulations. These pertain to analytical methods and detection limits as well as lists of determinands.

It is recognized that each industrial facility is unique, reflecting the nature of the operation, the materials it employs and the size of the facility. The list of determinands should reflect the activities that take place at any given facility, but in the urban WFD context, consideration should be given to introduce a minimum list of determinands.

For reporting and review purposes, it is recommended that relevant compliance monitoring data be transferred to EPA's EDEN database through the following steps:

- Review of monitoring requirements for licensed facilities;
- Introduction of a degree of harmonisation in monitoring requirements (parameters, accuracy, detection limits);
- Storage of license requirements in a database linked to EDEN (or within EDEN);
- Provision of web interface for reporting of monitoring data by licensees (or its laboratory) and EPA;
- Functionality in the reporting system to highlight non-compliance, late reporting, etc.

EDEN is initially addressing the storage and retrieval of surface WFD data; the addition of GW and related license data should not require any structural changes to the database and the web interface could follow the model(s) already implemented by the EPA for other data sets.

The proposed code of practice would include the following:

- Convention for labelling of groundwater samples (e.g., upgradient, downgradient, bedrock, subsoil, etc.);
- List of (priority) determinands to be analysed;
- Identification of detection limits for all determinands;
- Electronic retrieval and submittal of data generated.

It is recognised that different IPPC facilities will be required to submit varying levels of data, depending on their licensing requirements. However, the crucial item here is the electronic delivery into a database that EPA can access and maintain, and data arriving in the same format and to the same reporting standards.

Consistent delivery of data to local authorities and the EPA will make subsequent reviews considerably more cost-effective.

5.3.4.2 Monitoring Well Survey

EPA records indicate that the precise locations and screened depths of existing monitoring wells at IPPC facilities are generally not known. It is therefore proposed that a survey of IPPC facilities be carried out to locate wells individually and determine well depths and the depth intervals they monitor. The onus could initially be on the facility owners to provide the information.

This information is important for EPA's analysis and statistical review of groundwater quality data. It is important, for example, to distinguish upgradient and downgradient wells, and wells that are screened in subsoils versus those screened within bedrock aquifers.

The information should be compiled into a national register and accessible in a GIS.

5.3.5 Groundwater and SuDS

SuDS are defined by CIRIA as "a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques" (CIRIA, 2007).

SuDS intend to capture, store and/or infiltrate stormwater as a means of reducing runoff to streams or stormdrains. In most cases, SuDS are intended to reduce the flooding potential of a development area with the primary objective of maintaining the natural hydrological balance and water quality of an associated receptor stream. The need for control of stormwater runoff has long been recognised in Dublin, where new development pressures have grown on peri-urban areas which represent the upstream ends of catchments (McEntee, 2007) and which tend to be natural groundwater recharge areas. As a result, Dublin has been at the forefront of promoting SuDS in Ireland. DCC was the first local authority to adopt SuDS as part of its stormwater management policy and SuDS are now compulsory in local authorities who have adopted the Dublin drainage policies unless the developer can demonstrate that SuDS are impractical due to site circumstances (which can be of a hydrogeological nature). Where SuDS cannot be provided, the developer is required to provide alternative means of dealing with potential runoff pollutants.

The number of SuDS constructed in Ireland is not precisely known but is expected to be in the thousands, ranging from small soakaways to drains and swales along roadways and larger detention basins within urban footprints. Just about every planning application for a new development incorporates some types of SuDS. There is growing concern about potential (cumulative) impacts on groundwater quality from such developments, primarily because perceived impacts have not been empirically verified or disregarded. SuDS were recently the subject of the 2006 annual meeting of the Irish chapter of the International Association of Hydrogeologists (IAH), and were similarly on the agenda of the International Diffuse Pollution (DIPCON) conference in Dublin in 2003.

The design approach for SuDS typically includes a "treatment train" methodology for runoff. Different SuDS options provide different removal efficiencies and would therefore imply different degrees of risk of groundwater pollution. An exhaustive review of published material on the performance of various SuDS components is provided by Pratt (2004). This review would suggest that risks to groundwater are mostly limited, but acknowledges that the natural "treatment" efficiencies of SuDS are subject to site-specific conditions in the subsurface environment.

Schluter (2007) reported that the performance of nearly 50% of in-ground SuDS in Scotland was compromised by poor construction and lack of maintenance programmes. Similar statistics are not available for Ireland.

Groundwater pollution risks are recognised in the Dublin drainage policies which call for appropriate SuDS design on a case-by-case basis. While groundwater conservation and protection are stated goals of the Dublin drainage policies, groundwater monitoring is not believed to be carried out at any of the existing larger SuDS sites in Dublin or elsewhere in Ireland. Monitoring needs in most areas of Dublin would be less critical than other Irish towns where pollution susceptibility would be greater as a function of higher groundwater vulnerability.

A SuDS Evaluation Tool was rolled out nationally in 2007 (www.irishsuds.com). This tool recognises the role of groundwater conditions in the selection of appropriate drainage systems, albeit in a cursory manner. The specific variable used is depth to groundwater, which relates to the ability to infiltrate water (i.e., capacity). The term vulnerability appears as a selection function, but only to indicate if vulnerability is "high" or not. It does not reflect actual vulnerability as mapped by the GSI or on a site-specific basis on behalf of the developer.

The SuDS guidance document that accompanies the evaluation tool addresses potential impacts to groundwater through a qualitative "response matrix" which screens out SuDS options according to perceived pollution risk and draws upon source protection terminology. In cases where the infiltration capacity is deemed acceptable, the recommendation of the evaluation tool is to investigate soil conditions before infiltration options are considered further in design.

The attributes that are presently built into the tool do not provide sufficient guidance on potential groundwater recharge and quality impacts. It is recommended that the evaluation tool be supported further to add hydrogeological factors in greater detail. This includes consideration of:

- Soil types and texture;
- Soil/subsoil organic content;
- Subsoil thickness and permeability;
- Underlying rock types (flow characteristics);
- Proximity and location of groundwater source protection zones.

As well, the choice of SuDS design will depend on the pollutants that are expected to be or preferably, are measured in the runoff.

The focus of supporting guidance would be on preparing guidance for site-suitability of different SuDS options using relevant national mapping information and developing criteria for design parameters.

There has been very little investigation of the pollution impact of urban infiltration systems on groundwater, although it is noted that the recent tender for SuDS design in the Monard mixed-use development in County Cork called for groundwater monitoring associated with the hydrological greenfield study of the Blarney River and tributaries.

It is recommended that a groundwater quality impact study be carried out at a small number of representative sites around the country. Shallow groundwater quality would be monitored locally around significant (large) recent or planned SuDS, in areas of extreme groundwater vulnerability. A survey of SuDS performance is also recommended, similar to the work carried out in Scotland, so that future policy and practice be adjusted accordingly. Implementation of a registration system for future schemes is also recommended.

Depending on the results of such an impact study, future large-scale SuDS in vulnerable groundwater areas may need to incorporate groundwater quality as an element of routine SuDS performance monitoring.

5.3.6 Groundwater Awareness in Urban Development

The local authority planning system controls new development. The local area development plans that were reviewed as part of this POMs study rarely make reference to groundwater. Most plans highlight a need to protect and enhance the environment and ecology in general terms, but groundwater receives brief attention only in counties where it serves as a source of public water supply. An exception is the strategic environmental assessment (SEA) of the Draft Kilkenny County Development Plan (CAAS, 2007) which draws links between groundwater resources and 'areas under urban influence', whereby new development zoning is located over "groundwater which is probably at significant risk". The SEA further acknowledges that new developments "would have to be very carefully prepared and scrutinised in order to anticipate and avoid impacts".

While urban GWBs are not considered to be important sources of public water supply, this POMs study suggests that there may be many more private users of urban groundwater in industrial and commercial sectors of the economy. As such, these supplies are at risk from urban pollution, whether or not they are used consumptively.

Future groundwater abstraction licensing (CDM, 2008c) will address controls on abstractions and intended uses. However, given observations about urban groundwater quality in Section 4, it would appear that a greater awareness of linkages of land use activities to groundwater resources is merited in urban planning, particularly where groundwater is used. In such cases, groundwater monitoring and control plans may be warranted. Such plans can be incorporated into RBMPs for respective RBDs in future RBMP cycles. Candidate cities where groundwater protection and management plans are merited are (as priority) Drogheda, Portlaoise, Waterford, Dublin, Ennis, and Limerick. These are towns where groundwater is used for public supply, groundwater quality has been impacted, or where groundwater is at particular high risk from being polluted.

SuDS policies are increasingly becoming integrated into the planning and construction of new urban developments. As SuDS is becoming accepted policy across Ireland, awareness of groundwater pollution risk in urban developments should be promoted, as this could influence how specific SuDS under consideration are dealt with at any given location or catchment.

As local authority planning staff will tend to use existing policies and reference documents to guide decision-making, it is recommended that specific hydrogeological factors such as vulnerability be incorporated into existing reference documents and guidance tools. For example, there is linkage in literature between deterioration of groundwater quality and density of residential development in groundwater vulnerable areas.

The ecological focus of the WFD requires that planning includes a catchment-based approach whereby water quality and quantity have to be maintained to achieve good ecological status. Greater awareness of groundwater resources would contribute to ensuring that BMPs are selected and maintained.

Central elements to long—term groundwater protection are awareness and monitoring. Once degraded, the financial and political consequences of restoration can be considerable.

5.3.7 Less Stringent Objectives

Achievement of good status objectives may not always be possible or feasible within WFD-stipulated schedules. For such cases, "less stringent objectives" (LSOs) may apply. Per Annex 2 of the WFD (2000):

> "In cases where a body of water is so affected by human activity or its natural condition is such that it may be infeasible or

> unreasonably expensive to achieve good status, less stringent environmental objectives may be set on the basis of appropriate, evident and transparent criteria, and all practicable steps should be taken to prevent any further deterioration of the status of waters."

Annex 2 of the WFD states that GWBs which are considered likely to require LSOs should be identified on the basis of groundwater levels and groundwater quality.

The decisions about LSOs will be made following EPA's formal status classification and once POMs are adopted from the RBMPs. All candidate LSO cases have to undergo tests for disproportionate costs (i.e., cost/benefit analysis) which have not yet been formulated.

6. Conclusions and Recommendations

A national further characterisation (FC) study of urban groundwater pressures and impacts has been carried out to support the Programmes of Measures phase of WFD implementation in Ireland. The study included 33 urban areas, defined as those having a population greater than 10,000 people from the 2002 Census. The principal objectives of the study were to:

1. Develop an improved description of groundwater pressures across urban footprints in Ireland;
2. Rank and group Irish urban areas according to specific groundwater pollution risk factors;
3. Describe the water quality of urban groundwater bodies (GWBs) using available datasets;
4. Identify suitable measures that will: a) improve the collective knowledge of urban groundwater pressures; and b) protect urban groundwater resources and associated receptors.

All urban areas involve pollution risk to groundwater resources. However, there are degrees of risk depending on urban-specific factors. These relate to the magnitude and variety pressures that are present within the urban footprint, the natural hydrogeology associated with the urban area, and the presence or absence of human or ecological receptors. Groundwater resources in some urban areas are afforded natural geological protection against pollution where thick and low permeability subsoils are present. In other towns, groundwater may have a lower inherent resource value as the natural hydrogeology does not provide opportunities for extensive groundwater use.

On the basis of a scoring and weighting methodology, the 33 urban areas that are deemed to pose the greatest risk to groundwater are unsurprisingly, some of the larger towns in Ireland, including those that are associated with industry: Waterford, Dublin, Sligo, Limerick, Galway, Ennis and Drogheda.

A review of groundwater quality data indicates that urban pollutants are detected in a variety of urban settings across the country. There is some evidence of impacts from sewage, industrial activities, and waste facilities.

Because of limitations associated with existing datasets, broader conclusions about degrees and magnitudes of impact to groundwater quality can only be described for Waterford, Dublin, Drogheda and Swords. Results partly verify the risk assessment. From the available data, Waterford can be highlighted as a city where groundwater quality has been compromised over a wider area within the urban footprint. Area-weighted concentrations across the Waterford urban GWB exceeded drinking water standards for indicator parameters of urban pollutants such as ammonium, metals, and trace organic compounds. Waterford has several known point sources of pollution and traces of sewage-related compounds have also been detected in urban wells.

Across Dublin, the groundwater quality in the (deeper) Calp limestone has been impacted locally by industrial activity. Documented impacts are associated with industrial facilities which are under licensing review, investigation, or remediation by the EPA. Shallow groundwater in Dublin's city centre is showing signs of sewage and trace organic pollution. Trace organics are primarily associated with past contaminated land sites along the Liffey and harbour area. While of limited extent, the shallow sand and gravel aquifer is in direct hydraulic communication with Dublin Bay and the lower Liffey. Groundwater hydraulics is strongly influenced by tides, and there is considerable mixing with seawater along the natural discharge zone between groundwater and seawater. The mixing implies a high degree of dilution. Compared to direct wastewater discharges and stormwater runoff, groundwater is a minor source of mass flux to Dublin Bay.

Data from Drogheda and Swords indicate localised impacts around industrial facilities or landfills, but few or no other problems on the wider urban groundwater body scale. In Cork and Limerick, industries are mostly located outside their immediate urban footprints, and while Cork has groundwater quality problems, these are associated with saline, tidal waters and past sewage-related impacts which will have been reduced by the recent completion of the Cork Main Drainage Scheme.

Groundwater quality impacts in most other towns can only be inferred as a general lack of urban data does not allow for similar conclusions to be drawn. However, where relevant samples have been taken, traces of pollutants can be found. This does not imply that the quality of groundwater resources in all towns is compromised. Urban groundwater pollution is a very site-specific science, and a great deal of additional study and monitoring would be needed to draw definitive conclusions about broader impacts across the country.

Urban groundwater is not an important source of water for public supply at the present time. Only three public supply wells in two towns, Portlaoise and Drogheda, pump groundwater from within urban footprints. Nearly half of the towns are also situated on rock types that are classified as "poorly productive" and are therefore less likely to be exploited in the future for large public water supplies.

While few public supply wells exist within urban footprints, groundwater is used for industrial purposes, ranging from small car washing facilities to larger food processing plants. The full extent of industrial and commercial groundwater use in urban areas is not known. Fifty-five wells have been verified through this study as occurring within urban areas, but the actual number is expected to be considerably higher. A survey of wells in urban areas is recommended, and known wells should be added to the national abstraction register developed as part of a different FC study on groundwater abstraction pressures (CDM, 2008c).

Ecological receptors of urban groundwater discharges are rivers, estuaries, and groundwater dependent terrestrial ecosystems (GWDTEs). The recent ecological status classification of surface water bodies compiled by the EPA indicates that several urban rivers and estuaries are impaired and of "less than good status" (as defined by the EPA). However, the sources of problems are primarily attributed to urban wastewater discharges and morphological pressures.

GWDTEs have been defined within three urban footprints across Ireland; Maynooth/Leixlip, Galway, and Sligo. Only Ryewater Valley, a GWDTE and cSAC, is flagged by the NPWS (NPWS, 2008) as being at risk of not meeting WFD status objectives on the basis of growing urban pressures associated with the towns of Maynooth and Leixlip. The environmental supporting conditions for GWDTEs are generally poorly understood, and will be subject to study and monitoring by the NPWS in the future.

From the review of pressures and impacts, recommendations for programmes of measures (POMs) have been developed to guide future groundwater protection. In the urban groundwater context, POMs are mitigation measures that would be required to ensure that WFD status objectives are met in all water bodies by year 2015, and that areas that are not yet impacted remain adequately protected from future water quality deterioration.

EPA's status classification of urban GWBs will drive the need for measures in any given town. The classification will partly be guided by this study. From the risk screening and review of available groundwater quality data, Waterford would probably qualify as a candidate for "less than good" (LTG) qualitative (chemical) status on the basis of several exceedances of EPA's status classification criteria for water quality. As such, Waterford would require site-specific measures targeting known pollution problems and overall aquifer protection goals. All other urban areas would be subject to the same pollution prevention measures and expanded monitoring.

There are numerous statutory instruments (acts, legislation) in place that are directly or indirectly protective of groundwater resources in urban settings. For example, under existing legislation, the EPA has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection. If fully (100%) implemented, the existing statutory instruments should be sufficient to eliminate point sources of pollution, at least those that are associated with EPA-licensed facilities. In practice, elimination of point sources of pollution is difficult to achieve due to accidental spills or poor handling practices by facility operators.

The review of pressures and water quality impact in this study has uncovered several opportunities to improve the collective knowledge of urban groundwater characteristics across the country. These can be regarded as recommendations that would serve as supplementary measures to existing legislation. They fall into five broad classes, as follows:

- Surveys, mapping, and research;
- Codes of practice;
- Groundwater quality monitoring;
- Improved infrastructure;
- Planning.

The recommended supplementary measures address particular data and information gaps that have come to light during this FC study, and provide guidance as to how capture of such missing information would enhance the understanding of urban pressures, water quality impacts and environmental controls.

The recommended supplementary measures were summarised in **Table 22**. Many address data capture and reporting of environmental quality data. Others target research and surveys that are needed to verify or diminish existing perceptions of risk factors relating to diffuse pressures. As such, the urban groundwater study provides guidance as to the primary needs for improved environmental monitoring. Some of the needs will be addressed by the EPA as their enforcement and monitoring programmes evolve during subsequent river basin management cycles.

The list of recommended supplementary measures is long, and implementation will require time and coordination amongst the various stakeholders involved. Priorities can be argued, but certain activities can be implemented relatively quickly and with fewer requirements in terms of resources and funding. Overall, the target of measures should be an increased awareness of groundwater as a potential resource and as a potential pathway for pollutants to reach receptors. The documented water quality problems in Waterford are largely the result of urban development taking place with insufficient consideration of local hydrogeological conditions.

The future protection and management of urban groundwater resources in Ireland should evolve with greater awareness of the linkages between land use planning, drainage concepts, and water supply needs, even if the latter is implemented mainly with industrial and commercial activities in mind. The means by which this can evolve is through environmental monitoring and enforcement and, importantly, by making full use of asset management capabilities and data capture tools. Groundwater should be accorded a greater influence in urban development plans, at least where groundwater is an important natural resource for both humans and local ecology.

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Appendix A:
Attributes Used in the Risk Ranking of Urban Areas

Source	Industry Amenity Transport Roads Effective Rainfall Sewers

Pathway	Vulnerability Aquifer Type

Receptor	Human Ecological

Table A-1: Overview of Attributes Used for Risk Ranking of Urban Areas

	Attribute	Data Source	Data Format/ Type	Description	Data/Information Gaps	Index	Index Notes	Overall Weight
Source	Industrial - Magnitude	Local Authorities	GIS - landuse zoning	The percent area of industry was determined using the reclassifications in 39325/UP40/DG19. There were two subcategories of industry defined; heavy (large manufacturing and processing operations) and light (light business and technology industries, and associated services). The total of heavy and light industry was used.	National consistency in landuse classifications	3 = Total area of industry > 20 % 2 = Total area of industry > 10 % 1 = Total area of industry > 0 % 0 = None	Industrial area as a % of total built-up area; extra index score of 1 assigned to urban areas with heavy industry	3
	Industrial - Variety	Contaminated Land Manufacturing Landfills Waste	GIS layer	A list of IPPC licences, Waste licences (including landfills) and contaminated land was provided by the EPA. The numbers of sites in each urban area was determined.	Inconsistencies in reporting	5 = Variety > 10 3 = Variety > 5 1 = Variety > 1 0 = Variety = 0	Based on the number of point sources Each point source has a different weight (see next page)	4
	Amenity Open space	Local Authorities	GIS - landuse zoning	Development plan landuse classifications were used to identify areas of parks, sporting or recreational grounds. Each local authority defines these differently and classifies them differently. The best estimate of percent area of amenity open space was used.	Quantitative data on usage of pesticides and fertilisers.	4 = > 6 % 3 = > 4 % 2 = > 2 % 1 = < 2 %	Open space as % of built up area. Index based on percentage area range	3
	Road	OSI	GIS layer	The length of national roads outside the built-up area but within the urban footprint was calculated. It was assumed that these stretches of national roads outside the built up area are likely to have filter drains.	Mapping of secondary roads not available.	2 = Density > 0.5 (km/km2) 1 = Density < 0.5 (km/km2) 0 = None	Index based on density range	2
	Rail/airports	Irish Rail/ OSI		Locations of railway depots and maintenance yards were obtained per comm. from Irish rail. Airports were identified from OSI maps.		2 = Railway depot within urban footprint 1 = Railway station within urban footprint 0 = None	Presence/ Absence	1
	Sewer Density	NUWWS & GDSDS reports	Statistics from reports & sewer network modelling	Statistics regarding sewer length was readily available from the NUWWS study and Dublin City Council (for Greater Dublin). These files were from MapDrain and SuS25, and were converted into ArcGIS. The sewer length per urban area was then extracted. From the lengths of sewer it was possible to deduce the density of sewer within the urban areas; by dividing the sewer length by the urban area.	Integrity information very generalised. No information on sewer elevations in relation to groundwater. Exfiltration estimates not possible.	4 = > 15 (km/km2) 3 = > 10 (km/km2) 2 = > 5 (km/km2) 1 = < 5 (km/km2)	Index based on density range	2
	Effective rainfall	Met Eireann	GIS layer	This is a raster GIS layer used by the RBDs for risk assessments in 2005. The average was estimated for each urban area.		3 = Effective rainfall >= 800 mm 2 = Effective rainfall >= 500 mm 1 = Effective rainfall < 500 mm	Index based on range	2
Pathway	GW vulnerability	GSI	GIS layer	The national groundwater vulnerability map was obtained from the Geological Survey of Ireland (GSI). It was intersected with the built-up urban area and the percent area of vulnerabilit categories were calculated.	Lack of resolution in areas not yet mapped by the GSI.	5 = X-Extreme and Extreme > 25 % 4 = High > 50 % 3 = X-Extreme and Extreme >10 %or High > 25 % or High to Low > 50 % 2 = X-Extreme and Extreme and High > 25 % 1 = Other	Vulnerability as % of built up area. Index based on percentage area range	5
	Flow regime	GSI	GIS layer	The national groundwater body layer was used to determine the most dominant groundwater flow regime within the urban area. It should be noted that some towns and cities are associated with shallow sand and gravel deposits that do not represent formal GWBs, but that would be imrpotant in urban-specific contaminant fate and transport studies.		4 = Karst (3 = if equal karst and PP) 3 = S&G 2 = Fi 1 = PP	Index based on the dominant type of flow regime. Index over written if known gravel layers	3
Receptor	Ecological	NPWS and DEHLG NPWS and DEHLG OSI n/a	GIS layer - SACs and GWDTE GIS layer	The presence or absence of GWDTEs and SACs were noted if within or downgradient of an urban area. The national list of priority groundwater dependant ecosystems (GWDTEs) was obtained from NPWS in 2006. Detailed boundaries of many GWDTEs have not yet been developed by the NPWS, in which case SAC boundaries were used. The presence or absence of other rivers or estuaries was also noted.	Detailed delineations of GWDTE boundaries and their environmental supporting conditions.	3 = GWDTE 2 = SAC 1 = Other Water Receptor 0 = None	Presence/ Absence	5
	Wells	EPA RBDs compiled data; GSI n/a		Well locations were taken from the national Register of groundwater abstractions developed as part of the accompanying FC study on groundwater abstraction pressures (CDM, 2009).	Source protection areas and detailed zones of contribution are largely missing for public and private supply wells in urban areas. Existing Register of abstractions underestimates the number of industrial/commercial wells in urban areas.	2 = DW (public or private) 1 = Industrial 0 = None	Presence/ Absence	5

Table A-2: Source Attributes for Each Urban Area

Name	Total built up area (km^2)	Industrial Magnitude						Industry Numbers[1]								Amenity		Roads		Transport (Rail, Airport)		Effective Rainfall	Sewer Density		
		Light Industry (km^2)	Heavy Industry (km^2)	Total existing industry (km^2)	% Light Industry	% Heavy Industry	% Total industry of built up area	IPPC GW	Waste GW	Section 4 Risk to GW	Cont. Land	Landfills	Total # point sources (GW)	Industrial Legacy[2]	Industrial Variety[3]	Total area of amenity within built up area (km^2)	% amenity within built up area	Total length National Roads (km) per urban footprint	Density	Railway Line	Railway Depot - storage	Effective Rainfall - Ave mm/yr	Total length sewer (km)	Sewer catchment area (km^2)	Density sewer catchment (km)
Athlone	5.74	1.38	0.00	1.38	24.05	0.00	24.05	0	0	0	1	0	1	0	3	0.11	1.93	8.65	4.48	1	0	500	110.30	9.62	11.46
Balbriggan	2.73	0.94	0.00	0.94	34.42	0.00	34.42	0	0	0	0	0	0	0	0	0.11	4.07	2.69	0.66	1	0	395	41.24	7.31	5.64
Bray	5.48	0.33	0.00	0.33	6.04	0.00	6.04	0	0	0	0	0	0	0	0	0.10	1.83	0.48	0.26	1	0	792	151.83	7.13	21.28
Carlow	4.11	0.68	0.00	0.68	16.58	0.00	16.58	1	0	0	0	0	1	0	1	0.07	1.64	6.74	4.10	1	0	458	65.00	11.34	5.73
Carrigaline	3.56	0.22	0.00	0.22	6.10	0.00	6.10	0	0	0	0	0	0	0	0	0.03	0.75	0.00	0.00	0	0	713	57.39	5.22	10.99
Castlebar	4.87	0.28	0.00	0.28	5.74	0.00	5.74	0	0	0	0	0	0	0	0	0.21	4.39	6.58	1.50	1	0	985	92.92	5.92	15.69
Celbridge	2.69	0.10	0.00	0.10	3.67	0.00	3.67	0	0	0	0	0	0	0	0	0.06	2.30	0.00	0.00	0	0	365	34.88	7.72	4.52
Clonmel	5.38	n/a	n/a	0.50	n/a	n/a	9.29	2	0	0	2	0	4	0	8	0.40	7.43	5.45	0.73	1	0	600	24.69	9.18	2.69
Cork	27.21	1.14	0.59	1.74	4.19	2.18	6.38	1	0	2	0	1	4	1	8	1.83	6.74	35.10	5.21	1	0	707	513.52	49.19	10.44
Drogheda	9.33	2.49	0.00	2.49	26.72	0.00	26.72	1	0	0	1	1	3	1	7	0.31	3.33	8.14	2.44	1	0	411	64.23	13.43	4.78
Dublin	207.62	35.87	2.70	38.58	17.28	1.30	18.58	19	7	0	5	3	34	1	48	12.63	6.08	153.68	25.27	1	1	560	3477.91	431.09	8.07
Dundalk	18.27	0.86	0.06	0.92	4.69	0.33	5.03	2	1	0	0	1	4	0	5	0.24	1.31	24.39	18.67	1	0	403	172.70	17.18	10.05
Ennis	11.39	0.38	0.00	0.38	3.38	0.00	3.38	0	0	0	1	1	2	0	5	0.23	2.03	13.81	6.80	1	0	820	91.85	9.59	9.58
Galway	23.47	2.27	0.00	2.27	9.66	0.00	9.66	1	0	0	1	0	2	0	4	1.47	6.28	18.60	2.96	1	0	777	345.89	18.63	18.57
Greystones	5.16	0.32	0.00	0.32	6.27	0.00	6.27	0	0	0	0	0	0	0	0	0.11	2.12	0.00	0.00	1	0	682	80.07	4.92	16.27
Kilkenny	7.06	0.89	0.00	0.89	12.57	0.00	12.57	1	0	0	0	0	1	0	1	0.24	3.37	7.30	2.17	1	0	483	83.50	9.25	9.02
Killarney	4.81	0.17	0.00	0.17	3.54	0.00	3.54	1	0	0	0	0	1	0	1	0.05	1.01	11.23	11.10	1	0	1138	72.61	10.03	7.24
Leixlip	2.72	0.53	0.00	0.53	19.52	0.00	19.52	1	0	0	0	0	1	0	1	0.13	4.78	0.00	0.00	1	0	352	38.90	7.92	4.91
Letterkenny	11.67	2.82	0.00	2.82	24.13	0.00	24.13	1	0	0	0	0	1	0	1	0.05	0.43	8.03	18.53	0	0	863	55.49	7.98	6.95
Limerick	12.09	0.11	0.00	0.11	0.91	0.00	0.91	0	0	0	1	1	2	1	6	0.63	5.21	17.48	3.35	1	0	650	269.28	32.03	8.41
Malahide	3.19	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0.13	4.03	0.00	0.00	1	0	317	64.15	3.79	16.94
Maynooth	2.74	0.02	0.00	0.02	0.91	0.00	0.91	0	0	0	0	0	0	0	0	0.09	3.33	0.00	0.00	1	0	378	8.85	6.45	1.37
Mullingar	4.92	0.33	0.00	0.33	6.74	0.00	6.74	0	1	0	2	0	3	0	7	0.03	0.52	4.45	8.58	1	0	540	103.44	8.91	11.60
Naas	5.90	0.61	0.00	0.61	10.39	0.00	10.39	1	0	0	1	0	2	0	4	0.11	1.89	3.00	1.59	0	0	457	127.78	10.07	12.69
Navan	6.00	0.07	0.00	0.07	1.25	0.00	1.25	1	1	0	0	0	2	0	2	0.26	4.27	8.10	1.90	0	0	470	104.00	13.46	7.73
Newbridge	3.77	0.41	0.28	0.69	10.86	7.46	18.33	1	0	0	0	0	1	0	1	0.04	1.00	0.01	0.01	1	0	471	112.79	6.86	16.45
Portlaoise	7.34	1.20	0.00	1.20	16.41	0.00	16.41	0	1	0	1	0	2	0	4	0.11	1.46	4.94	3.39	1	1	534	82.75	6.31	13.11
Sligo	10.69	1.43	0.00	1.43	13.40	0.00	13.40	1	1	0	0	0	2	0	2	0.07	0.66	11.78	17.96	1	0	785	97.50	8.53	11.43
Swords	7.32	2.23	0.24	2.47	30.48	3.26	33.74	3	0	0	2	0	5	0	9	0.31	4.19	4.94	1.18	0	0	345	115.58	12.49	9.25
Tralee	7.55	1.00	0.00	1.00	13.22	0.00	13.22	0	0	0	0	0	0	0	0	0.25	3.25	9.40	2.90	1	0	970	104.36	14.11	7.40
Tullamore	5.17	0.04	0.00	0.04	0.83	0.00	0.83	0	1	0	0	0	1	0	1	0.15	2.80	10.98	3.91	1	0	420	31.55	7.04	4.48
Waterford	11.74	n/a	n/a	3.46	n/a	n/a	29.46	2	1	0	2	0	5	1	10	1.50	12.77	7.77	0.61	1	0	610	212.38	18.61	11.41
Wexford	5.64	0.55	0.68	1.23	9.76	12.01	21.76	0	0	0	1	0	1	0	3	0.13	2.31	0.00	0.00	1	0	573	71.00	7.49	9.48

[1] Number of facilities by type
[2] Industrial legacy is given a score of 0 or 1 depending on whether or not urban area is associated with past manufacturing
[3] Industrial score is calculated using the following weights (which are different for types of facilities) - i.e., variety score = no. of facilities multiplied by weight summed for each type of industry

	Weight
IPPC	1
Waste	1
Section 4	2
Contaminated Land	3
Landfill	2

Example: Dublin = (19x1)+(7x1)+(0x2)+(5x3)+(3x2)+1 = 48

Table A-3: Pathway Attributes for Each Urban Area

Name	Total built up area (km^2)	Groundwater Vulnerability X-Extreme and Extreme (km^2)	High (km^2)	High to Low (km^2)	% X-Extreme and Extreme	% High	% High to Low	Flow Regime % Poorly Productive	% Gravel	% Fissured	% Karstic	Dominant flow regime	Note
Athlone	5.74	0.00	0.00	5.74	0.00	0.04	99.89	99.16	0.00	0.00	0.00	PP	
Balbriggan	2.73	0.25	0.00	2.48	9.32	0.00	90.65	99.81	0.00	0.00	0.00	PP	
Bray	5.48	1.31	1.19	0.07	23.96	21.72	1.22	99.16	0.00	0.00	0.00	PP	
Carlow	4.11	0.32	0.00	3.79	7.68	0.10	92.05	0.00	100.00	0.00	0.00	S&G	
Carrigaline	3.56	1.95	1.59	0.00	54.92	44.83	0.10	43.28	0.00	0.00	53.22	K	
Castlebar	4.87	0.27	0.00	4.59	5.51	0.00	94.32	0.00	0.00	0.00	100.00	K	
Celbridge	2.69	0.09	2.50	0.00	3.52	92.72	0.00	100.00	0.00	0.00	0.00	PP	
Clonmel	5.38	0.59	0.00	4.03	10.94	0.00	74.78	0.00	0.00	0.00	93.14	K	
Cork	27.21	9.68	17.30	0.12	35.58	63.58	0.43	34.75	0.00	0.00	65.09	K	This applies to Karstic GWB which underlies S&G of Lee River Valley
Drogheda	9.33	0.83	0.01	8.18	8.90	0.09	87.69	0.00	0.00	0.00	98.77	K	
Dublin	207.62	8.62	0.00	198.99	4.15	0.00	95.84	100.00	0.00	0.00	0.00	PP	This applies to Calp limestone GWB which underlies all of city. S&G in city centre not factored in.
Dundalk	18.27	2.91	0.00	15.30	15.91	0.00	83.75	93.27	6.40	0.00	0.00	PP	
Ennis	11.39	6.17	4.23	0.03	54.20	37.16	0.31	0.36	0.00	0.00	99.43	K	
Galway	23.47	9.08	0.00	14.28	38.71	0.00	60.84	49.49	0.00	0.00	50.42	K and PP	Aquifer type different west and east of the Corrib
Greystones	5.16	1.33	3.13	0.00	25.86	60.64	0.00	100.00	0.00	0.00	0.00	PP	
Kilkenny	7.06	0.19	6.87	0.00	2.75	97.24	0.00	3.17	96.61	0.00	0.22	S&G	
Killarney	4.81	0.00	0.00	4.81	0.00	0.00	100.00	5.84	0.00	0.00	94.16	K	
Leixlip	2.72	0.12	2.09	0.00	4.57	76.62	0.00	100.00	0.00	0.00	0.00	PP	
Letterkenny	11.67	8.21	3.46	0.00	70.36	29.64	0.00	83.13	16.87	0.00	0.00	PP	
Limerick	12.09	0.66	0.00	11.42	5.46	0.00	94.44	0.00	0.00	99.77	0.00	Fi	
Malahide	3.19	0.60	0.00	2.55	18.96	0.00	79.93	98.21	0.00	0.00	0.00	PP	
Maynooth	2.74	0.05	0.71	0.00	1.72	25.94	0.00	100.00	0.00	0.00	0.00	PP	
Mullingar	4.92	0.11	0.00	4.82	2.20	0.00	97.80	100.00	0.00	0.00	0.00	PP	
Naas	5.90	0.00	2.66	0.00	0.05	45.14	0.00	81.15	3.82	0.00	15.02	PP	
Navan	6.00	0.42	3.29	0.00	6.93	54.76	0.00	16.38	0.00	83.62	0.00	Fi	
Newbridge	3.77	0.00	3.77	0.00	0.00	100.00	0.00	0.00	99.97	0.00	0.00	S&G	
Portlaoise	7.34	0.09	4.17	0.00	1.16	56.82	0.00	35.15	17.44	0.00	47.38	K	
Sligo	10.69	0.84	0.00	9.56	7.88	0.00	89.41	17.88	0.00	0.00	80.12	K	
Swords	7.32	0.01	0.00	7.30	0.18	0.00	99.80	99.98	0.00	0.00	0.00	PP	
Tralee	7.55	1.86	0.00	5.68	24.61	0.00	75.26	1.79	0.00	0.00	97.78	K	
Tullamore	5.17	0.00	0.00	5.17	0.00	0.00	99.89	39.97	0.00	0.00	60.01	K	
Waterford	11.74	2.06	0.01	8.25	17.55	0.10	70.27	0.00	0.00	100.85	0.00	Fi	
Wexford	5.64	1.04	0.00	4.60	18.44	0.00	81.56	89.99	0.00	8.85	0.00	PP	

Table A-4: Receptor Attributes for Each Urban Area

Name	Groundwater Abstractions			Ecological Receptors			
	GW used for drinking water supply	GW used not for drinking water supply (industrial)	Notes	GWDTE [1]	SACs River, lake, estuary or wetland (not GWDTE)	Other River, lake, estuary (not SAC)	GWDTE
Athlone	0	0		0	1	1	
Balbriggan	0	0		0	0	1	
Bray	0	0		0	0	1	
Carlow	0	0		0	1	1	
Carrigaline	0	0		0	0	1	
Castlebar	0	0		0	0	1	
Celbridge	0	0		0	0	1	
Clonmel	0	0		0	1	1	
Cork	0	0		0	0	1	
Drogheda	1	1	Drybridge PWS and Ballymakenny GWS	0	1	0	
Dublin	1	1	Private industries	0	1	1	
Dundalk	0	0		0	1	1	
Ennis	0	0		0	1	1	
Galway	0	0		1	0	0	Lough Corrib and Galway Bay Complex
Greystones	0	0		0	1	1	
Kilkenny	0	0		0	1	1	
Killarney	0	0		0	1	1	
Leixlip	0	0		1	0	0	Rye Water Valley/Carton
Letterkenny	0	0		0	1	1	
Limerick	1	1	Private industries	0	1	0	
Malahide	0	0		0	1	0	
Maynooth	0	0		0	0	1	
Mullingar	0	0		0	0	0	
Naas	0	0		0	0	1	
Navan	0	0		0	1	0	
Newbridge	0	0		0	0	1	
Portlaoise	1	0	Portlaoise-Meelick PWS	0	0	1	
Sligo	0	0		1	1	1	Lough Gill
Swords	0	0		0	1	1	
Tralee	1	0	Private industries	0	1	1	
Tullamore	1	0	Private industry	0	0	1	
Waterford	1	0	Private industries	0	1	1	
Wexford	0	0		0	1	1	

[1] GWDTE - Groundwater Dependent Terrestrial Ecosystem (wetlands) -designated by National Parks and Wildlife Service

Appendix B:
Risk Ranking of Urban Areas

Appendix B: Overall Risk Ranking of Urban Areas

							Source										**Pathway**						**Receptor**			**Sum**
Urban Area	Industry Magnitude		Industry Variety		Amenity		Roads		Rail/air		Effective Rainfall		Sewer Density		Vertical Pathway		Horizontal Pathway		Wells		Ecological					
	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Source [1]	Pathway [1]	Receptor [1]	GRAND TOTAL [2]
Athlone	3	3	1	4	1	3	2	2	1	1	2	2	3	2	3	5	1	3	0	5	3	5	31	18	15	64
Balbriggan	3	3	0	4	3	3	1	2	1	1	1	2	2	2	3	5	1	3	0	5	1	5	27	18	5	50
Bray	1	3	0	4	1	3	1	2	1	1	2	2	4	2	3	5	1	3	0	5	1	5	21	18	5	44
Carlow	2	3	0	4	1	3	2	2	1	1	1	2	2	2	3	5	2	3	0	5	3	5	20	21	15	56
Carrigaline	1	3	0	4	1	3	0	2	0	1	2	2	3	2	5	5	2	3	0	5	1	5	16	31	5	52
Castlebar	1	3	0	4	3	3	2	2	1	1	3	2	4	2	3	5	4	3	0	5	1	5	31	27	5	63
Celbridge	1	3	0	4	2	3	0	2	0	1	1	2	1	2	4	5	1	3	0	5	1	5	11	23	5	39
Clonmel	1	3	3	4	4	3	1	2	1	1	2	2	1	2	3	5	4	3	0	5	3	5	32	27	15	74
Cork	2	3	3	4	4	3	2	2	1	1	2	2	3	2	5	5	2	3	0	5	1	5	41	31	5	77
Drogheda	3	3	3	4	2	3	2	2	1	1	1	2	1	2	3	5	4	3	2	5	2	5	34	27	20	81
Dublin	4	3	5	4	4	3	3	2	2	1	2	2	3	2	3	5	2	3	2	5	3	5	58	21	25	104
Dundalk	2	3	1	4	1	3	2	2	1	1	1	2	3	2	3	5	1	3	0	5	3	5	25	18	15	58
Ennis	1	3	1	4	2	3	1	2	1	1	3	2	2	2	5	5	4	3	0	5	3	5	24	37	15	76
Galway	1	3	1	4	4	3	1	2	1	1	2	2	4	2	5	5	3	3	0	5	3	5	30	34	20	84
Greystones	1	3	0	4	2	3	0	2	1	1	2	2	4	2	5	5	1	3	0	5	3	5	20	28	15	63
Kilkenny	2	3	0	4	2	3	1	2	1	1	1	2	2	2	4	5	2	3	0	5	3	5	19	26	15	60
Killarney	1	3	0	4	1	3	2	2	1	1	3	2	2	2	3	5	4	3	0	5	3	5	20	27	15	62
Leixlip	2	3	0	4	3	3	0	2	1	1	1	2	1	2	4	5	1	3	0	5	3	5	17	23	20	60
Letterkenny	3	3	0	4	1	3	1	2	0	1	3	2	2	2	5	5	1	3	0	5	3	5	23	28	15	66
Limerick	1	3	3	4	3	3	2	2	1	1	2	2	2	2	3	5	3	3	2	5	2	5	34	24	20	78
Malahide	0	3	0	4	3	3	0	2	1	1	1	2	4	2	3	5	1	3	0	5	2	5	17	18	10	45
Maynooth	1	3	0	4	2	3	0	2	1	1	1	2	1	2	3	5	1	3	0	5	1	5	12	18	20	50
Mullingar	1	3	3	4	1	3	1	2	1	1	2	2	3	2	3	5	1	3	0	5	0	5	30	18	0	48
Naas	2	3	1	4	1	3	1	2	0	1	1	2	3	2	3	5	1	3	0	5	1	5	22	18	5	45
Navan	1	3	1	4	3	3	2	2	0	1	1	2	2	2	4	5	3	3	0	5	2	5	23	29	10	62
Newbridge	3	3	0	4	1	3	1	2	1	1	1	2	4	2	4	5	2	3	0	5	1	5	24	26	5	55
Portlaoise	2	3	1	4	1	3	1	2	2	1	2	2	3	2	4	5	3	3	2	5	1	5	26	29	15	70
Sligo	2	3	1	4	1	3	2	2	1	1	2	2	3	2	3	5	4	3	0	5	6	5	27	27	30	84
Swords	4	3	3	4	3	3	1	2	0	1	1	2	2	2	3	5	1	3	0	5	3	5	38	18	15	71
Tralee	2	3	0	4	2	3	2	2	1	1	3	2	2	2	3	5	4	3	2	5	3	5	25	27	25	77
Tullamore	1	3	0	4	2	3	2	2	1	1	1	2	1	2	3	5	3	3	2	5	1	5	16	24	15	55
Waterford	4	3	3	4	4	3	1	2	1	1	2	2	3	2	3	5	3	3	2	5	3	5	45	24	25	94
Wexford	4	3	1	4	2	3	0	2	1	1	2	2	2	2	3	5	1	3	0	5	3	5	29	18	15	62

[1] Total of Index x Weight for Source, Pathway and Receptor.
[2] Overal Score - Total of Source, Pathway and Receptor (Index x Weight).

See Appendix A for derivation of indices

Appendix C:
Wells Sampled During 2007/2008

Table C-1: Summary of Sampled Wells and Associated Landuse Zoning

Well Summary							Land Use Zoning [2]		
Well Code	Urban Area	Type	Water Use	Estimated Depth (m)	Well Completion Type [1]	Abstraction Rate (m^3/day)	City Centre	Mixed Use	Residential/ Light Industrial
BAL01	Balbriggan	Private	Process	90	WS	600			IL/ RE
CAR01	Carlow	Private	Process	~ 50	WS	unknown			IL
CRK01	Cork	Private	Geothermal heat	15	WS	unknown	TC		
CRK02	Cork	Private	Pumped to prevent flooding	4.1	WS	245			RE/ (Ag)
DRO01	Drogheda	Group	Drinking water	75	WS	1,100			RE/ MU/ (Ag)
DRO02	Drogheda	Public	Drinking water	56	WS	250			MU/ IL/ (Ag)
DRO03	Drogheda	Private	Food production	120	WS	460			RE/ IL
DRO04	Drogheda	Private	Drinking and process	~ 65	WS	unknown		RE/ IL	
DUB01A	Dublin	Private	Observation	8	MW	0	TC/ MU		
DUB01B	Dublin	Private	Observation	32	MW	0	TC/ MU		
DUB02	Dublin	Private	Not in use	~27.5	WS	600	TC/ IH/ IL/ MU/ RE		
DUB03	Dublin	Private	Food production	~ 45	WS	1,000			IL/ MU
KIL01	Kilkenny	Private	Food production	90	WS	80-90			MU/ RE/ OM
LIM01	Limerick	Private	Washing and drinking	~ 70	WS	3			RE
NAA01	Naas	Private	Food production	54	WS	140			IL
POR01	Portlaoise	Public	Drinking water	9.5	WS	773			IL/ (Ag)
TRA01	Tralee	Private	Concrete plant	30	WS	< 66		MU/ IL/ RE/ OM	
WAT01	Waterford	Private	Process	21	WS	175	TC		
WAT02	Waterford	Private	Process	180	WS	150			RE
WAT03	Waterford	Private	Process	~ 50	WS	600		RE/ IL/ CM	
WEX01	Wexford	Private	Not in use	~ 70	WS	0			RE/ IL

[1] Well completion type:

WS	Water supply well
MW	Monitoring Well

[2] Land Use Zoning abbreviations:

TC	Town Centre
MU	Mixed Use
RE	Residential
IL	Industrial - Light
IH	Industrial - Heavy
CM	Commercial
OM	Open Managed
(Ag)	Agriculture

Table C-2: Associated Hydrogeology

Well Code	Groundwater Body Name	Hydrometric Area	Bedrock	Subsoil	Soil	Flow Regime	Aquifer Type	Vulnerability
BAL01	Balbriggan Urban	8	Silurian Metasediments and Volcanics	Made	Made	Poorly Productive	PPA	High to Low
CAR01	Carlow Town 1	14	Dinantian Dolomitised Limestones	Made	Made	S&G	Rg	High to Low
CRK01	Cork City 2	19	Dinantian Pure Unbedded Limestones	Made	Made	S&G	Rg	High
CRK02	Cork City 1	19	Dinantian Mudstones and Sandstones	Made	Made	S&G	Rg	Extreme
DRO01	Drogheda Urban	7	Dinantian Pure Bedded Limestones	IrSTLPSsS	AminPD	Karstic	Rk	High to Low
DRO02	Drogheda Urban	7	Dinantian Pure Bedded Limestones	IrSTLPSsS	AminPD	Karstic	Rk	High to Low
DRO03	Drogheda Urban	7	Dinantian Upper Impure Limestones	Made	Made	Productive Fissured	Lm	High to Low
DRO04	Drogheda Urban	7	Dinantian Pure Bedded Limestones	Made	Made	Karstic	Rk	High to Low
DUB01	Dublin Urban	9	Dinantian Upper Impure Limestones	Made	Made	S&G	Lg	High to Low
DUB02	Dublin Urban	9	Dinantian Upper Impure Limestones	Made	Made	Poorly Productive	Ll	High to Low
DUB03	Dublin Urban	9	Dinantian Upper Impure Limestones	Tls	BminPD	Poorly Productive	PPA	High to Low
KIL01	Kilkenny Town 1	15	Dinantian Pure Bedded Limestones	Made	Made	Karstic	Rk	High
LIM01	Limerick Urban SE	25	Dinantian Pure Bedded Limestones	Made	Made	Productive Fissured	Lm	High to Low
NAA01	Naas Bedrock Sth Urban	9	Dinantian Lower Impure Limestones	Made	Made	Poorly Productive	Lm	High
POR01	Portlaoise Town 4	14	Dinantian Pure Bedded Limestones	GLs	BminSP	S&G	Rk	High
TRA01	Tralee_1	23	Dinantian Pure Unbedded Limestone	Made	Made	Karstic	Rk	High to low
WAT01	Waterford City	16	Ordovician Volcanics	Made	Made	Productive Fissured	Rf	Extreme
WAT02	Waterford City	16	Ordovician Volcanics	Rck	AminSW	Productive Fissured	Rf	X-Extreme
WAT03	Waterford City	16	Ordovician Volcanics	Made	Made	Productive Fissured	Rf	High to Low
WEX01	Wexford Town	12	Cambrian Metasediments	Made	Made	Poorly Productive	PPA	High to Low

Table C-3: Sampling Point Information

Sample Code	Landuse Observations *(within 100m of the well)*	Notes on Sampling Point
BAL01	Mixed use. Part residential, part industrial, nearby golf course.	Tap on discharge line inside a pump house.
CAR01	Mixed use. Edge of town, beside main national road, part residential, nearby petrol station.	A valve on the outside of well casing. Well inside brick sump flush with ground.
CRK01	Built-up area, city centre, heavy traffic and construction.	A valve after merger of 3 discharge lines (from three wells). 150 m from River Lee.
CRK02	Mixed use, site of a water treatment plant.	Infiltration gallery - bailer used to withdraw sample.
DRO01	Group water scheme located at the edge of the urban area. Light industry located in neighbouring premises.	Valve on holding tank.
DRO02	Located at margin of city boundary adjoining an agricultural area.	A valve on inlet pipe of storage tank.
DRO03	Located in a residential area with neighbouring industrial site.	A tap on discharge line in pump house.
DRO04	Built-up residential area.	A tap on discharge line located within a factory building. Well is inside building and inside a manhole.
DUB01	College grounds.	Low flow pump used. Well covered by manhole on grassy ground.
DUB02	Large industrial site.	A valve on inlet pipe of storage tank. Well is located inside a warehouse, underneath a flush-mounted metal cover.
DUB03	Mixed use, downgradient of airport. Nearby tillage fields and a light industrial site.	A valve on inlet pipe to the storage tank. Well located in field behind main facility.
KIL01	Industrial and residential area.	Well in flush-mounted chamber. Sample collected from outside tap.
LIM01	Mixed use, mainly residential.	Well in flush-mounted chamber. Sample collected from outside tap. Well located in car park under manhole. Oil spill observed in car park.
NAA01	In an industrial estate on the outskirts of the urban area.	Well inside manhole. Sample collected from tubing that came off the top of the well.
POR01	Located just inside the town boundary, so it is not in a built up area. There was a disused cattle mart, now used for horse sales in the neighbouring premises.	A tap on outside of 40 cm high protective casing.
TRA01	Industrial estate neighbouring a residential area.	Well inside brick hut. Sample collected from tubing at storage tank.
WAT01	Close to river downgradient of city centre.	A valve on discharge line located within a building. Well is in car park on raised concrete platform with metal cover.
WAT02	On an industrial facility in a built-up area with the hospital nearby.	A valve on discharge line of small storage tank. Well located in covered concrete sump.
WAT03	Industrial.	A short piece of tubing coming off a tap on the discharge pipe. Well located inside brick hut in facility storage area.
WEX01	Mixed use, mostly residential.	Low flow pump used. Disused production well covered by manhole inside disused car park.

Appendix D:
Groundwater Quality Data

FullCounty	Sampdate	Approx. Easting	Approx. Northing	RBD	EPA Regional Water Lab.	Sample Type	pH_fld	Temperature fld	Diss. Oxygen_fld_1	Diss. Oxygen_fld_2	Cond. fld	pH	Cond. (at 25°C)	Ammonia	Chloride	Total PO_4	Total Reactive Phosphorus	Ortho-phosphate	Iron	Manganese	Total Coliforms	Faecal Coliforms	Nitrite N	Total Oxidised Nitrogen	Nitrate N	Nitrate NO_3	Fluoride	Sulphate
							pH	°C	% Sat	mg/l O_2	uS/cm	pH	uS/cm	mg/l N	mg/l Cl	mg/l P	mg/l P	mg/l P	mg/l Fe	mg/l Mn	No./100ml	No./100ml	mg/l N	mg/l N	mg/l N	mg/l NO_3	mg/l F^-	mg/l SO_4
							pH field	Temp field	D_field (%s	O_field (mg	Cond field						TRP							TON				
Louth	16/09/1997	307800	275800	Eastern	MON							7.24	682	0.01	29			0.01	< 0.05	< 0.02	3	0	0.001		2.07	9.17	0.083	32
Louth	04/02/1998	307800	275800	Eastern	MON							7.07	692	0.01	27			0.01	< 0.05	< 0.02	0	0	0.002		1.7	7.53	0.094	34
Louth	07/09/1998	307800	275800	Eastern	MON							7.16	637	0.01	27			0.01	< 0.05	< 0.02	0	0	0.001		1.59	7.04	0.071	21
Louth	02/02/1999	307800	275800	Eastern	MON							7.38	707	< 0.01	26			< 0.01	< 0.05	< 0.02	0	0	< 0.005		1.76	7.79	0.128	31
Louth	08/09/1999	307800	275800	Eastern	MON							7.4	647	< 0.01	28			0.02	0.031	< 0.0005	0	0	< 0.002	1.57		6.95*	< 0.300	30
Louth	02/03/2000	307800	275800	Eastern	MON			5.6	24.6			7.2	598	< 0.01	25			0.01	< 0.02	< 0.0005	0	0		1.31		5.80*		33
Louth	25/10/2000	307800	275800	Eastern	MON							7.3	684	0.27	31			0.06	< 0.05	< 0.001	0	0	1.35	1.42		6.29*	< 0.300	30
Louth	23/01/2001	307800	275800	Eastern	MON			4.3	12.5			7.2	718	0.26	31			< 0.02	< 0.05	< 0.001	0	0	0.015	< 0.03		< 0.13*	0.693	34
Louth	26/09/2001	307800	275800	Eastern	MON			7.3	13.4		680	7.2	689	< 0.03	34			< 0.02	< 0.05	< 0.001	0	0	0.021	1.61		7.13*	< 0.300	33
Louth	09/04/2002	307800	275800	Eastern	MON			5.2	11.1		698	7.3	715	< 0.03	36			< 0.02	< 0.05	< 0.001	1	0	0.005	2.07		9.17*	< 0.150	38.8
Louth	18/09/2002	307800	275800	Eastern	MON			4.8	12.7		679	7.2	681	< 0.03	38			< 0.02	0.0993	< 0.001	0	0	0.008	1.78		7.88*	nm	nm
Louth	17/02/2003	307800	275800	Eastern	MON		7.37	3.4	16.8		679	7.1	686	< 0.03	39			< 0.02	0.145	< 0.001	0	0	0.014	1.79		7.93*	< 0.150	34.2
Louth	20/08/2003	307800	275800	Eastern	MON		7.44	5.6	11.9		687	7.2	691	< 0.03	42			< 0.02	0.0686	< 0.001	0	0	0.003	1.9		8.41*	< 0.150	35.9
Louth	09/02/2004	307800	275800	Eastern	MON		7.6	3.7	20.2		708	7.3	718	< 0.03	41			< 0.02	0.1077	< 0.001	0	0	0.003	1.83		8.10*	< 0.150	37.9
Louth	26/08/2004	307800	275800	Eastern	MON		7.44	6.3	12.4		676	7.1	694	< 0.03	40			< 0.02	0.0845	< 0.001	0	0	fqc	1.84		8.15*	< 0.150	39.5
Louth	15/02/2005	307800	275800	Eastern	MON		6.97	6.6	17.4		681	7.2	677	< 0.03	40			< 0.02	0.0638	< 0.001	0	0	0.003	1.49		6.6*	< 0.150	40.4
Louth	06/09/2005	307800	275800	Eastern	MON		7.05	10	19.8		650	7.2	673	< 0.03	40			< 0.02	0.0784	< 0.001	0	0	< 0.003	1.67		7.383*	< 0.150	40.4
Louth	02/02/2006	307800	275800	Eastern	MON		7.14	7.7	22.7		635	7.4	662	< 0.03	38			< 0.02	0.103	< 0.001	0	0	0.003	2.29	2.287*	10.128*	< 0.150	43
Carlow	14/11/2000	273700	177500	South Eastern	KIK	Bore		11.4				7.5	704		24				0.121	0.036	0	0			1	4.43		53
Carlow	01/10/2001	273700	177500	South Eastern	KIK	Bore		12.5				7.5	696	0.004	23			0.007	< 0.05	0.0276	< 1	< 1	< 0.001		0.1	0.44	0.22	53
Carlow	05/03/2002	273700	177500	South Eastern	KIK	Bore		11.5				7.3	707	< 0.003	27			< 0.006	< 0.06	0.037	> 201	1	< 0.001		0.2	0.89	0.17	53.6
Carlow	10/10/2002	273700	177500	South Eastern	KIK	Bore		11.9				7	700	< 0.003	23			< 0.006	< 0.06	0.036	0	0	< 0.001		0.2	0.89	0.2	55.8
Carlow	12/02/2003	273700	177500	South Eastern	KIK	Bore		10				7.3	700	0.021	23			0.007	0.1064	0.0284	0	0	< 0.001		0.1	0.44	nm	nm
Carlow	22/09/2003	273700	177500	South Eastern	KIK	Bore		12				7.4	709		27			0.012	0.0806	0.0396	1	0	< 0.001		0.3	1.33	0.2	61.5
Carlow	26/02/2004	273700	177500	South Eastern	KIK	Bore		11.2				7.4	703	< 0.003	25			< 0.006	0.0974	0.0331	0	0	< 0.001		0.48	2.12	0.16	57.7
Carlow	05/10/2004	273700	177500	South Eastern	KIK	Bore		12.7				7.4	703	0.005	24			0.006	0.348	0.0983	0	0	< 0.001		0.23	1.02	0.19	53.3
Carlow	09/03/2005	273700	177500	South Eastern	KIK	Bore		14.5				7.6	705	0.005	22			< 0.006	0.135	0.0313	1	0	< 0.001		< 0.06	< 0.27	0.18	55.4
Carlow	07/11/2005	273700	177500	South Eastern	KIK	Bore		11				7.3	710	< 0.003	26			< 0.006	0.15	0.0379	0	0	< 0.001		0.2	0.89	0.18	68.2
Carlow	02/05/2006	273700	177500	South Eastern	KIK	Bore		11.9				7.5	706	< 0.003	20			< 0.006	0.0866	0.0296	0	0	< 0.001		0.1	0.44	0.18	56.4
Louth	12/08/1996	304100	307500	Neagh Bann	MON	Bore						7.2	821	0.01	33			0.01	< 0.05	< 0.02	0	0	0.003		6.5	28.78	0.123	14
Louth	11/02/1997	304100	307500	Neagh Bann	MON	Bore						7.25	831		32			0.01	< 0.05	< 0.02	0	0	0.001		4.72	20.90	0.13	72
Louth	10/09/1997	304100	307500	Neagh Bann	MON	Bore						7.21	834	0.01	33			0.01	< 0.05	< 0.02	0	0	0.001		6.28	27.81	0.103	100
Louth	09/10/1997	304100	307500	Neagh Bann	MON	Bore																						
Louth	26/01/1998	304100	307500	Neagh Bann	MON	Bore						7.18	833	0.01	30			0.01	< 0.05	< 0.02	0	0	0.002		5.42	24.00	0.113	48
Louth	07/10/1998	304100	307500	Neagh Bann	MON	Bore						7.25	851	0.01	30			0.01	0.05	< 0.02	0	0	0.09		5.31		0.11	93
Louth	02/03/1999	304100	307500	Neagh Bann	MON	Bore						7.33	826	0.01	27			0.02	< 0.05	< 0.02	0	240	< 0.005		5.54	24.53	0.108	74
Louth	25/08/1999	304100	307500	Neagh Bann	MON	Bore						7.31	830	0.01	30			0.01	< 0.05	< 0.02	0	0	0.001		5.69	25.20	0.057	61
Louth	08/09/1999	304100	307500	Neagh Bann	MON	Bore						7.6	795	< 0.01	28			0.01	0.0339	0.0052	0	0	< 0.002	4.66		20.63*	< 0.300	65
Louth	18/02/2000	304100	307500	Neagh Bann	MON	Bore		12.1	39			7.3	801	< 0.01	27			0.01	< 0.02	0.0077	0	0	< 0.002	4.81		21.30*		71
Louth	06/09/2000	304100	307500	Neagh Bann	MON	Bore		17.3	27.7			7.4	799	< 0.03	28			< 0.02	< 0.03	0.0063	0	0	< 0.002	4.29		19.00*	< 0.300	67
Louth	14/02/2001	304100	307500	Neagh Bann	MON	Bore		14.2	36.1			7.3	805	< 0.03	27			< 0.02	< 0.05	0.0058	0	0	< 0.002	4.32		19.13*	< 0.300	64
Louth	18/09/2001	304100	307500	Neagh Bann	MON	Bore		12.9	28.5		788	7.3	810	< 0.03	29			< 0.02	< 0.05	0.0115	0	0	< 0.002	4.43		19.62*	< 0.300	65
Louth	09/04/2002	304100	307500	Neagh Bann	MON	Bore		12.3	19.3		800	7.2	808	< 0.03	30			< 0.02	< 0.05	0.0175	1	0	< 0.002	4.26		18.87*	< 0.150	62.5
Louth	21/08/2002	304100	307500	Neagh Bann	MON	Bore		13.9	21		793	7.3	798	< 0.03	29			< 0.02	0.0995	0.0096	0	0	< 0.002	3.99		17.67*	< 0.150	64.4
Louth	25/02/2003	304100	307500	Neagh Bann	MON	Bore	7.3	11.6	31		810	7.5	814	< 0.03	33			< 0.02	0.1056	0.0113	0	0	< 0.002	3.89		17.23*	0.16	62.5
Louth	22/09/2003	304100	307500	Neagh Bann	MON	Bore	7.49	13.5	16.4		788	7.2	794	< 0.03	28			< 0.02	0.1059	0.0104	0	0	< 0.002	4.82		21.35*	< 0.150	59.6
Louth	27/01/2004	304100	307500	Neagh Bann	MON	Bore	7.27	13.5	22.2		799	7.4	793	0.03	29			< 0.02	0.0808	0.01	0	0	< 0.002	3.26		14.44*	< 0.150	56..13
Louth	15/09/2004	304100	307500	Neagh Bann	MON	Bore	7.18	14.7	21.9		781	7.1	806	< 0.03	28			< 0.02	0.0749	0.0105	0	0	< 0.003	3.46		15.32*	< 0.150	53.5
Louth	15/02/2005	304100	307500	Neagh Bann	MON	Bore	7.02	13.2	17.6		770	7.3	782	< 0.03	28			< 0.02	0.064	0.0115	0	0	< 0.003	3.18		14.08*	< 0.150	53.2
Louth	01/09/2005	304100	307500	Neagh Bann	MON	Bore	7.1	15.6	20.2		740	7.6	763	0.03	27			0.05	0.0726	0.0184	0	0	< 0.003	3.35		14.823*	< 0.150	46.2
Louth	02/02/2006	304100	307500	Neagh Bann	MON	Bore	6.83	21.6	20.7		733	7.6	762	< 0.03	26			< 0.02	0.0953	0.0115	0	0	< 0.003	2.8	2.8*	12.4*	< 0.150	50.5
Kerry	13/12/1995	85300	114700	Shannon	DUB							7.07	659	0.036	23.38			0.012	1.493	0.332				0.129	0.15	0.66		9.22
Kerry	21/08/1996	85300	114700	Shannon	COR							7.27	665	0.049	28.3				1	0.12			< 0.005		0.09	0.42		9.61
Kerry	04/12/1996	85300	114700	Shannon	COR							7.44	662	0.044	27.9								0.005	0.13		0.57*		9.55
Kerry	18/08/1997	85300	114700	Shannon	COR							7.35	660	0.035	26.2			0.045					0.01	0.03	0.02	0.09		8.71
Kerry	03/12/1997	85300	114700	Shannon	COR							7.31	664	0.036	29.6			0.006					0.006	0.13	0.13	0.57	< 0.20	10.4
Kerry	07/09/1998	85300	114700	Shannon	COR							7.1	669	0.038	28.1			0.006	0.6	0.24			< 0.005	0.12	0.12	0.52		10.1
Kerry	12/01/1999	85300	114700	Shannon	COR							7.13	667	0.036	28.2			< 0.005	0.76	0.22			< 0.005	0.16	0.16	0.70		10.7
Kerry	23/08/1999	85300	114700	Shannon	COR							7.13	670	0.021	29.2			0.1	0.415	0.224			< 0.005	0.16		0.70*	< 0.20	11
Kerry	09/02/2000	85300	114700	Shannon	COR			11.5				7.23	677	0.033	26.9			0.017	0.589	0.23			< 0.005		0.2	0.93	< 0.20	10.8
Kerry	06/09/2000	85300	114700	Shannon	COR			12.2	24.2	2.6	636	7.2	667	0.036	26.8			< 0.005	0.933	0.286			< 0.010		< 0.22	< 1.00	< 0.10	9.5
Kerry	24/01/2001	85300	114700	Shannon	COR		7.12	11.4	30	3.16	637	7.33	674	0.028	24.8			< 0.005	< 0.05	< 0.002			< 0.010		< 0.5	10.30	1.92	10.2
Kerry	26/09/2001	85300	114700	Shannon	COR		7.11	12.1	8.3		630	7.11	660	0.027	25	< 0.005			0.537	0.257			< 0.010		< 0.5	< 1.00	< 0.10	10.6
Kerry	29/01/2002	85300	114700	Shannon	COR		7.05	11.5	11.2		637	7.07	664	0.023	26.4		0.006		0.488	0.294	0	0	< 0.010		< 0.5	< 1.00	< 0.10	11.7

FullCounty	Sampdate	Approx. Easting	Approx. Northing	RBD	EPA Regional Water Lab.	Sample Type	pH_fld	Temperature fld	Diss. Oxygen_fld_1	Diss. Oxygen_fld_2	Cond. fld	pH	Cond. (at 25°C)	Ammonia	Chloride	Total PO_4	Total Reactive Phosphorus	Ortho-phosphate	Iron	Manganese	Total Coliforms	Faecal Coliforms	Nitrite N	Total Oxidised Nitrogen	Nitrate N	Nitrate NO_3	Fluoride	Sulphate
							pH pH field	°C *Temp field*	% Sat *O_field (%s*	mg/l O_2 *O_field (mg*	uS/cm *Cond field*	pH	uS/cm	mg/l N	mg/l Cl	mg/l P	mg/l P *TRP*	mg/l P	mg/l Fe	mg/l Mn	No./100ml	No./100ml	mg/l N	mg/l N *TON*	mg/l N	mg/l NO_3	mg/l F^-	mg/l SO_4
Kilkenny	08/01/1996	251000	156500	South Eastern	KIK	Bore		9.5				7.9	690	< 0.01	19.7			< 0.001	< 0.06	< 0.02	5		< 0.003		5.9	26.13		40
Kilkenny	01/09/1997	251000	156500	South Eastern	KIK	Bore		16.7				8.4	130	0.03	3			0.09			160	120	0.018		0.5	2.21		< 1.5
Kilkenny	17/02/1999	251000	156500	South Eastern	KIK	Bore		9.7				7.9	690	< 0.2	18.8			< 0.04			9	0	< 0.003		6.6	29.22		37.9
Kilkenny	26/09/2000	251000	156500	South Eastern	KIK	Bore		14.6				7.6	708	< 0.003	18			< 0.006	< 0.06	< 0.02	47	3	< 0.001		6.2	27.45		39
Kilkenny	12/02/2001	251000	156500	South Eastern	KIK	Bore		9.3				7.5	726	0.01	21			< 0.006	< 0.06	< 0.02	> =5	0	0.001	7		31.0*	< 0.1	48.7
Kilkenny	27/09/2001	251000	156500	South Eastern	KIK	Bore		15.7				7.9	713	< 0.003	19			< 0.006	< 0.05	0.0038	4	< 1	< 0.001		9.5	42.05	< 0.1	37.3
Kilkenny	28/02/2002	251000	156500	South Eastern	KIK	Bore		10				7.8	717	0.009	19			< 0.006	< 0.06	< 0.02	44	0	0.001		8.3	36.74	< 0.1	32.4
Kilkenny	14/10/2002	251000	156500	South Eastern	KIK	Bore		8.5				7.5	720	0.008	19			0.006	< 0.06	< 0.02	56	0	< 0.001		7.6	33.66	< 0.1	36.3
Kilkenny	18/02/2003	251000	156500	South Eastern	KIK	Bore		6				7.6	720	0.123	19			< 0.006	0.0914	0.0047	66	0	0.005		7.5	33.20	nm	nm
Kilkenny	25/09/2003	251000	156500	South Eastern	KIK	Bore		15.1				8	712	< 0.003	18			< 0.006	0.0663	0.00375	517	1	< 0.001		9.8	43.38	0.1	35.9
Kilkenny	24/02/2004	251000	156500	South Eastern	KIK	Bore		5.6				7.8	686	0.062	19			< 0.006	0.101	0.00203	72	0	0.01		8.1	35.86	0.1	35.5
Kilkenny	11/10/2004	251000	156500	South Eastern	KIK	Bore		11.2				7.7	684	0.01	20				0.103	0.00621	291	4	0.017		7.8	34.54	< 0.10	34.3
Kilkenny	07/03/2005	251000	156500	South Eastern	KIK	Bore		5.2				7.6	536	0.063	19			< 0.006	0.142	0.00682	112	1	0.009		8.1	35.87	< 0.10	35.8
Kilkenny	08/11/2005	251000	156500	South Eastern	KIK	Bore		10.6				7.5	717	< 0.003	19			< 0.006	0.116	0.0142	387	0	< 0.001		6.2	27.46	< 0.10	40.3
Laois	22/08/1996	247800	197200	South Eastern	DUB	Bore						7.33	736	< 0.01	16.4			0.023	0.082	< 0.0005				3.841		17.00*		46.92
Laois	21/11/1996	247800	197200	South Eastern	DUB	Bore						7.19	777	< 0.01	15.78			0.017	9.253	0.0091				3.533		15.63*		45.53
Laois	03/11/1997	247800	197200	South Eastern	DUB	Bore		11.7				7.37	632	< 0.01	15.45			0.007	< 0.001	0.0005				3.423		15.16*		37.545
Laois	12/02/1998	247800	197200	South Eastern	DUB	Bore		11.1				7.43	655	< 0.01	15.6			0.014	0.0053	< 0.0005				4.39		19.44*		48.1
Laois	24/09/1998	247800	197200	South Eastern	DUB	Bore		11.7				7.3	677	< 0.01	14.6			0.005	0.0178	0.0009				3.671		16.25*		41.1
Laois	02/02/1999	247800	197200	South Eastern	DUB	Bore		10.4				7.184	657	< 0.01	13.9			0.012	0.0102	0.0015				4.117		18.23*		37.6
Laois	07/09/1999	247800	197200	South Eastern	KIK	Bore	7.25	11.5			746	7.4	746	< 0.2	18.4						0	0	< 0.03		3.2	14.17		31.6
Laois	18/01/2000	247800	197200	South Eastern	KIK	Bore		10.8				7.2	775	< 0.2	18			< 0.04	< 0.06	< 0.02	0	0	< 0.03		3.3	14.61		36
Laois	29/08/2000	247800	197200	South Eastern	KIK	Bore		11.2				7.26	764	0.013	19			< 0.006			7	0	< 0.001		2.8	12.40		27
Laois	23/01/2001	247800	197200	South Eastern	KIK	Bore		10.9				7.2	770	0.015	18			0.011	< 0.06	< 0.02	1	0	< 0.001	3.3		14.61*	0.1	36.8
Laois	25/09/2001	247800	197200	South Eastern	KIK	Bore	6.95	11.3	50	5.5	749	7.5	751	0.009	20			< 0.006	< 0.05	< 0.001	1	< 1	< 0.001		3.8	16.82	0.1	27.2
Laois	31/01/2002	247800	197200	South Eastern	KIK	Bore	7.13	10.8			749	7.4	743	0.016	19			0.011	< 0.06	< 0.02	0	nm	< 0.001		3.3	14.61	0.11	28.1
Laois	11/09/2002	247800	197200	South Eastern	KIK	Bore	6.5	11.8	52.2	5.6		7.2	760	< 0.003	21			< 0.006	< 0.06	< 0.02	14	0	< 0.001		3.3	14.61	< 0.1	26.4
Laois	11/02/2003	247800	197200	South Eastern	KIK	Bore		10.4	94	10.7	780		775	0.006	21			0.007	0.1304	< 0.001	1	0	0.001		3.7	16.39	nm	nm
Laois	18/11/2003	247800	197200	South Eastern	KIK	Bore		11.6			751	7.4	744	< 0.003	19			< 0.006			12	0	< 0.001		3.3	14.61	0.11	22.5
Laois	04/02/2004	247800	197200	South Eastern	KIK	Bore	6.42	11.4	51	5.49	731	7.5	751	0.005	20			0.006	0.063	< 0.02	2	0	< 0.001		3.2	14.17	0.13	27
Laois	10/11/2004	247800	197200	South Eastern	KIK	Bore	7.35	11	43.1	4.83	732	7.4	745	< 0.003	21			< 0.006	0.223	< 0.001	1	0	< 0.001		3.5	15.50		
Laois	15/02/2005	247800	197200	South Eastern	KIK	Bore	7.28	10.3	44.4	4.91	767	7.3	775	0.012	24			< 0.006	0.135	< 0.001	1	0	< 0.001		3.7	16.39		
Laois	25/10/2005	247800	197200	South Eastern	KIK	Bore	7.56	11.8	49.6	4.72		7.2	758	< 0.003	24			0.015	0.121	< 0.001	16	0	< 0.001		3.5	15.50	0.12	24.2
Laois	01/03/2006	247800	197200	South Eastern	KIK	Bore	7.95	9	61.3	9.17	1024	7.4	773	0.005	25			0.009			1	0	< 0.001		4.2	18.60	< 0.10	27.8
Louth	13/12/1995	309100	277000	Eastern	MON							7.65	525	0.01	21			0.08	< 0.05	0.02	0	0	0.001		1.43	6.33	0.169	5
Louth	12/08/1996	309100	277000	Eastern	MON							7.5	516	0.01	21			0.13	< 0.05	< 0.02	0	0	0.001		1.25	5.54	0.101	8
Louth	22/01/1997	309100	277000	Eastern	MON							7.5	518	0.01	20.65			0.076	< 0.05	0.01	0	0	0.001		0.913	4.04	0.089	10
Louth	10/09/1997	309100	277000	Eastern	MON							7.44	524	0.01	21			0.07	< 0.05	< 0.02	0	0	0.002		1.13	5.00	0.086	11
Louth	26/01/1998	309100	277000	Eastern	MON							7.47	519	0.01	21			0.06	< 0.05	0.02	0	0	0.001		1.01	4.47	0.083	7
Louth	07/09/1998	309100	277000	Eastern	MON							7.4	517	0.01	21			0.08	< 0.05	0.02	0	0	0.001		0.87	3.85	0.084	6
Louth	02/03/1999	309100	277000	Eastern	MON							7.57	519	< 0.01	21			0.09	< 0.05	< 0.02	0	0	< 0.005		0.84	3.72	0.115	11
Louth	08/09/1999	309100	277000	Eastern	MON							7.6	517	0.02	21			0.07	0.0323	0.0108	0	0	< 0.002	0.74		3.28*	< 0.300	9
Louth	02/03/2000	309100	277000	Eastern	MON			9.6	48.8			7.4	517	0.01	21			0.06	< 0.02	0.0086	0	0		0.73		3.23*		13
Louth	13/09/2000	309100	277000	Eastern	MON							7.5	526	< 0.03	22			0.05	< 0.05	0.0052	0	0	< 0.002	0.72		3.19*	< 0.300	11
Louth	23/01/2001	309100	277000	Eastern	MON			10.9	51.1			7.4	538	< 0.03	22			0.06	< 0.05	0.004	0	0	< 0.002	0.76		3.37*	0.953	17
Louth	26/09/2001	309100	277000	Eastern	MON			13.2	50.9		528	7.4	535	< 0.03	22			0.06	< 0.05	0.0043	0	0	< 0.002	0.73		3.23*	< 0.300	12
Louth	09/04/2002	309100	277000	Eastern	MON			11.8	54.7		529	7.5	550	< 0.03	23			0.06	< 0.05	0.0022			< 0.002	0.75		3.32*	< 0.150	12.2
Louth	22/04/2002	309100	277000	Eastern	MON																0	0						
Louth	18/09/2002	309100	277000	Eastern	MON			15.3	58.8		532	7.7	531	< 0.03	23			0.07	0.0711	0.0023	0	0	< 0.002	0.79		3.50*	nm	nm
Louth	17/02/2003	309100	277000	Eastern	MON		7.62	10	59.9		533	7.4	537	< 0.03	24			0.09	0.2261	0.0315	0	0	0.004	0.62		2.75*	< 0.150	12.4
Louth	09/02/2004	309100	277000	Eastern	MON		7.45	10.7	51.2		553	7.5	549	< 0.03	26			0.06	0.0874	0.0123	0	0	< 0.002	0.78		3.45*	< 0.150	13.6
Louth	26/08/2004	309100	277000	Eastern	MON			15.4	16.5		538	7.4	553	< 0.03	23			0.04	0.0706	0.0121	1	0	< 0.003	0.79		3.5*	< 0.150	13.6
Louth	15/02/2005	309100	277000	Eastern	MON		7.08	10.4	15.8		544	7.3	545	< 0.03	24			0.04	< 0.05	0.0125	0	0	< 0.003	0.87		3.85*	< 0.150	14.9
Louth	20/08/2005	309100	277000	Eastern	MON			15	74			7.6	535	< 0.03	23			0.05	< 0.05	0.0032	0	0	< 0.002	0.8		3.534*	< 0.150	13.3
Louth	06/09/2005	309100	277000	Eastern	MON		7.09	15.3	19.7		516	7.3	551	< 0.03	24			0.04	0.0609	0.0225	< 1	0	< 0.003	0.74		3.264*	< 0.150	14.3
Louth	02/02/2006	309100	277000	Eastern	MON		7.25	7.4	19.1		529	7.5	553	< 0.03	24			0.04	0.0753	0.0172	0	0	< 0.003	0.81	0.81*	3.587*	< 0.150	15.1

FullCounty	Sampdate	Total Organic Carbon	Sodium	Potassium	Magnesium	Calcium	Boron	Aluminium	Chromium	Nickel	Copper	Zinc	Arsenic	Cadmium	Antimony	Barium	Lead	Uranium	Cobalt	Molybdenum	Selenium	Silver	Thallium	Thorium	Tin	Vanadium	Berillium	Alkalinity	Total Hardness
		mg/l C TOC	mg/l Na	mg/l K	mg/l Mg	mg/l Ca	mg/l S_2^-	ug/l B	ug/l Al	ug/l Cr	ug/l Ni	ug/l Cu	ug/l Zn	ug/l As	ug/l Cd	ug/l Sb	ug/l Ba	ug/l Pb	µg/l U	mg/l Hg	µg/l Co	µg/l Mo	µg/l Se	µg/l Ag	µg/l Tl	µg/l Th	µg/l Sn	µg/l V	µg/l Be
Louth	16/09/1997	3.2	15.11	3.34	11.35	115					20	60		0.2														268	324
Louth	04/02/1998	0.8	15.38	6.82	5.62	140								0.2														248	298
Louth	07/09/1998	0.69	13.6	2.2	11	126.6								< 0.2														246	268
Louth	02/02/1999	1	12.91	2.81	12.31	130.02								< 0.2														280	380
Louth	08/09/1999	1.1	15.36	2.42	12.19	114.88	33.7		2.5	0.7	309.8	196	0.55	< 0.1		27.2	< 0.5											292	320
Louth	02/03/2000	2.8	12.59	2.28	10.43	96.55	< 20		0.8	1.3	335.5	457.1	< 0.5	< 0.1		33.6	< 0.5											256	304
Louth	25/10/2000		15.78	2.89	9.84	104.64	< 50	< 50	< 1	< 1	54.5	153.6	< 1	< 0.1	< 1	< 50	< 1	< 1	< 1	< 1	< 1	< 5	< 1	< 1	< 5	< 1	< 1	273	307
Louth	23/01/2001	0.6	24.99	4.45	12.63	121.27	< 50	< 50	< 1	< 1	37.1	248.8	< 1	< 0.1	< 1	< 50	< 1		< 1	< 1	< 1	< 5			< 5	< 1	< 1	296	336
Louth	26/09/2001	0.4	20.18	2.54	13.81	124.47	< 50		2.3	< 1	34.2	107.7	< 1	< 0.10		< 50	< 1	< 1										280	336
Louth	09/04/2002	0.4	17.79	3.29	12.59	124.08	< 50		< 1	< 1	40.1	109.2	< 1	< 0.10		< 50	< 1	< 1										284	380
Louth	18/09/2002	1.5	14.72	2.35	10.91	106.55	< 50		6.9	< 1	64.2	118.5	< 1	< 0.10		< 50	< 1	< 1										244	316
Louth	17/02/2003	0	14.25	4.46	10.38	130.16	< 50		4.4	1.7	176.4	563.2	< 1	0.2		< 50	< 1	< 1										258	308
Louth	20/08/2003	1.5	19.97	2.83	13.59	119.8	< 50		3.4	< 1	171	419.4	< 1	< 0.10		< 50	< 1	< 1										248	318
Louth	09/02/2004	2.3	17.46	4.79	12.28	121.66	< 50		8	1.9	155.3	410.4	< 1	< 0.10		< 50	< 1	< 1										324	344
Louth	26/08/2004	0.8	15.65	4.3	10.94	99.65	52.1		2.9	1.9	70.8	160.3	< 1	< 0.10		< 50	< 1	< 1										288	324
Louth	15/02/2005	0.5	15.42	3.66	10.92	106.66	< 50		4	< 1	82.1	179.3	< 1	< 0.10		< 50	< 1	< 1										246	154
Louth	06/09/2005	nm	12.87	3.09	9.56	96.6	< 50		< 1	< 1	70.6	176.2	< 1	< 0.10		< 50	< 1	< 1										252	308
Louth	02/02/2006	< 1.5	12.33	3.48	9.14	91.62	< 50		4.4	2.4	183.3	226.4	< 1	0.2		< 50	< 1	< 1										242	308
Carlow	14/11/2000		11	0.9			< 50	100	39	25	7		3	0.1	< 1	< 50	< 1				< 1								
Carlow	01/10/2001	2.79	11.6	0.7	27.1	90.5	< 50	< 50	4.5	2.2	< 1	25.9	1.9	< 0.10	< 1	< 50	< 1	3.2	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1		292	338
Carlow	05/03/2002	nm	12.3	2.5	27.5	104						42																292	373
Carlow	10/10/2002	0.85	10.7	0.7	25.9	100						27																nm	357
Carlow	12/02/2003	< 0.12	8.6	0.8	23.4	83.8	< 50	< 50	< 1	2.8	< 1	23.3	2.1	< 0.10	< 1	< 50	< 1	4.4	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1		269	306
Carlow	22/09/2003	nm	11	0.5	27	96	< 50	< 50	6.9	1.5	< 1	7.2	3.1	< 0.10	< 1	< 50	< 1	4.4	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1			351
Carlow	26/02/2004	0.4	7.99	0.51	19.6	70.3	< 50	nm	3.5	2.87	< 1	18.2	1.87	< 0.10	< 1	< 50	< 1	4.29	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1		292	256
Carlow	05/10/2004	0.31	8.23	0.68	22.6	99.8	< 50	< 50	12.4	5.72	< 1	67.3	6.83	< 0.10	< 1	< 50	< 1	4.06	< 1	< 1	< 1		< 1	< 1	< 50	< 1		290	343
Carlow	09/03/2005	1.5	7.04	0.78	19.5	86.3	< 50	< 50	3.5	4.19	< 1	37.8	2.29	< 0.10	< 1	< 50	< 1	4.55	< 1	< 1	< 1		< 1	< 1	< 50	< 1		293	296
Carlow	07/11/2005	0.6	10.6	0.79	23.4	93.9	< 50	< 50	9.19	3.93	< 1	21.9	3.19	< 0.10	< 1	< 50	< 1	4.1	< 1	< 1	< 1		< 1	< 1	< 50	< 1		296	331
Carlow	02/05/2006	nm	12.5	< 1	34.2	103	< 50	< 50	3.65	< 1	< 1	8.65	2.57	< 0.10	< 1	< 50	< 1	4.37	< 1	< 1	< 1		< 1	< 1	< 50	< 1		291	398.2
Louth	12/08/1996		24.74	3.81	26.87	110.8					< 10	< 10		0.2			< 0.8											312	412
Louth	11/02/1997		22.9	9.58	25.48	96.2					< 10	< 10		0.2			3											296	364
Louth	10/09/1997	4.6	23.21	4.66	28.29	102.8					30	20		0.2														300	364
Louth	09/10/1997																												
Louth	26/01/1998			10.45	38.76	114.6								0.2														252	356
Louth	07/10/1998	0.46	21.1	3.6	25	112.5								< 0.2														207	207
Louth	02/03/1999	0.7	24.31	4.04	31.03	123.8								< 0.2														284	376
Louth	25/08/1999	0.9	17.9	3.8	37	102.8								< 0.2														280	332
Louth	08/09/1999	0.9	25.34	4.76	29.87	116.71	113.2		1.1	0.6	13.4	14.6	0.55	< 0.05		112.9	0.8											312	364
Louth	18/02/2000	4.6	22.98	4.25	26.68	107.37	98.7		< 0.5	1	8.6	13.5	< 0.5	< 0.05		110.4	0.6											356	404
Louth	06/09/2000	4.3	23.75	4.31	13.34	107.15	103.8	< 20	< 1	< 1	17.1	11.1	< 1	< 0.1	< 1	110.6	1.2	1.29	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	280	384
Louth	14/02/2001	1.3	25.57	4.43	30.38	124.7	116	< 50	6.7	< 1	12.6	17.6	< 1	< 0.1	< 1	95.5	< 1		< 1	< 1	< 1	< 5			< 5	< 1	< 1	244	388
Louth	18/09/2001	1.6	23.83	4.69	27.75	109.55	96.2		2.9	< 1	12	60.2	< 1	< 0.10		102.2	1.4	< 1										316	376
Louth	09/04/2002	1.2	28.37	6.17	33.19	121.83	104.8		< 1	< 1	7.3	70	< 1	< 0.10		100	< 1	< 1										328	430
Louth	21/08/2002	5.1	21.78	4.14	21.6	105.69	97.6		2.5	< 1	12.4	64.4	< 1	< 0.10		114	< 1	< 1										304	440
Louth	25/02/2003	0.7	27.79	9.08	31.25	120.93	124.8		8	1.6	12.3	44.4	< 1	< 0.10		98.8	< 1	< 1										328	376
Louth	22/09/2003	4.5	21.98	4.97	28	110.84	91.8		12.5	1.5	20.7	36.2	< 1	< 0.10		100.9	< 1	< 1										372	412
Louth	27/01/2004	2.5	22.86	6.43	29.09	116.46	84.2		8.4	< 1	22.2	81.5	< 1	< 0.10		114.5	< 1	< 1										304	360
Louth	15/09/2004	2	22.97	6.92	32.83	106.08	81.8		4.1	< 1	27	24.9	< 1	< 0.10		80.2	< 1	< 1										750	840
Louth	15/02/2005	1.5	20.86	5.67	25.48	103.89	61.1		3.7	< 1	26.7	28.8	< 1	< 0.10		94.8	< 1	< 1										328	388
Louth	01/09/2005	nm	20.36	5.94	24.44	98.45	76.7		2.8	2	31.5	30.4	< 1	< 0.10		94.7	< 1	< 1										312	388
Louth	02/02/2006	< 1.5	16.71	4.74	22.87	88.5	< 50		2.9	< 1	34.6	32.6	< 1	< 0.10		91.5	2.5	< 1										320	344
Kerry	13/12/1995		16.25	0.81	5.07	119.56																						270	
Kerry	21/08/1996		15.6	0.85	4.31	108.1																						278	288
Kerry	04/12/1996	0.9	16.7	0.97	4.2	78.8																						300	214
Kerry	18/08/1997		15.1	0.87	4.6	109																						284	293
Kerry	03/12/1997		16.4	0.85	4.67	104																						305	280
Kerry	07/09/1998		16.1	0.88	4.11	74.1																						304	202
Kerry	12/01/1999		16.6	0.9	4.59	96		< 30																				266	259
Kerry	23/08/1999		16.3	0.89	4.07	100	12	98	4	13	< 0.005	886	2	< 1	< 1	22	< 1											299	268
Kerry	09/02/2000		16.3	0.9	4.26	115	< 20	< 20	4	12	< 5	19	2	< 1	< 1	15	< 1											317	304
Kerry	06/09/2000		16.2	0.91	4.48	120	< 50	< 50	4	13	< 5	23	3	< 1	< 1		< 1											311	317
Kerry	24/01/2001		13.9	2.85	16.8	102	< 50	< 50	12	2	< 5	8	< 1	< 1	< 1	< 50	< 1											313	323
Kerry	26/09/2001		17.2	1.01	4.49	127	< 50	< 50.0	3.2	11.3	3.7	12	2	< 0.1	< 1	< 50	< 1.0											310	336
Kerry	29/01/2002		14.4	1.03	4.21	115	< 50	< 50.0	< 1.0	13.3	9.8	25	2	< 0.1	< 1	< 50	< 1.0											305	304

FullCounty	Sampdate	Total Organic Carbon	Sodium	Potassium	Magnesium	Calcium	Boron	Aluminium	Chromium	Nickel	Copper	Zinc	Arsenic	Cadmium	Antimony	Barium	Lead	Uranium	Cobalt	Molybdenum	Selenium	Silver	Thallium	Thorium	Tin	Vanadium	Berillium	Alkalinity	Total Hardness
		mg/l C *TOC*	mg/l Na	mg/l K	mg/l Mg	mg/l Ca	mg/l S_2^-	ug/l B	ug/l Al	ug/l Cr	ug/l Ni	ug/l Cu	ug/l Zn	ug/l As	ug/l Cd	ug/l Sb	ug/l Ba	ug/l Pb	µg/l U	mg/l Hg	µg/l Co	µg/l Mo	µg/l Se	µg/l Ag	µg/l Tl	µg/l Th	µg/l Sn	µg/l V	µg/l Be
Kilkenny	08/01/1996	2.4	10.2	1.3	18.3							< 20																312	389
Kilkenny	01/09/1997	3.2																											
Kilkenny	17/02/1999	1.8	11.2	1.3	14.1																							270	
Kilkenny	26/09/2000		12	1.9	16							151																	360
Kilkenny	12/02/2001		10.7	2.2	16.9	124		< 50	< 1			133																296	
Kilkenny	27/09/2001	< 0.12	12.1	1.9	15.5	112.2	59.9	< 50	4.1	< 1	9	89.7	< 1	< 0.10	< 1	52.1	< 1	< 1	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1		380	344
Kilkenny	28/02/2002	nm	11.5	2.8	17.6	127						36																298	390
Kilkenny	14/10/2002	0.74	11.1	1.2	16.7	112						192																nm	349
Kilkenny	18/02/2003	0.79	16.2	2.5	22.2	136.4	< 50	< 50	< 1	< 1	15.1	60.9	< 1	< 0.10	< 1	< 50	< 1	< 1	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1			432
Kilkenny	25/09/2003	nm	11.6	1.5	17.3	110	52.9	< 50	6.51	< 1	< 1	52.5	< 1	< 0.10	< 1	75.9	< 1	< 1	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1			346
Kilkenny	24/02/2004	0.73	9.19	1.63	13.3	95.6	< 50	nm	< 1	< 1	5.71	45.5	< 1	< 0.10	< 1	85.8	< 1	< 1	< 1	< 1	< 1	< 50	< 1	< 1	< 50	< 1		272	294
Kilkenny	11/10/2004	0.38	11.9	2.04	16.4	105	51.4	< 50	< 1	< 1	11.8	64.5	< 1	< 0.10	< 1	50.7	< 1	< 1	< 1	< 1	< 1		< 1	< 1	< 50	< 1		269	330
Kilkenny	07/03/2005	1.06	7.89	1.95	12.9	107	< 50	< 50	< 1	2.42	8.22	60.7	< 1	< 0.10	< 1	61.1	< 1	< 1	< 1	< 1	< 1		< 1	< 1	< 50	< 1		314	321
Kilkenny	08/11/2005	0.7	10.4	2	14.7	107	< 50	< 50	4.42	< 1	6.16	214	< 1	< 0.10	< 1	57.3	1.99	< 1	< 1	< 1	< 1		< 1	< 1	< 50	< 1		298	328
Laois	22/08/1996		8.42	2.25	14.6	127.58																						340	
Laois	21/11/1996		8.63	2.24	11.49	132																						332	
Laois	03/11/1997		9.33	2.32	14.96	127.21																						332	
Laois	12/02/1998		10	3	16.5	134.4																						328	
Laois	24/09/1998		11.3	2.6	16	127.7																						308	
Laois	02/02/1999		7.1	1.8	10.1	85.3																						325	
Laois	07/09/1999		9.7	2.5																								338	
Laois	18/01/2000		5.4	< 0.3																								342	
Laois	29/08/2000		10.2	5	15																								394
Laois	23/01/2001		18.9	10.2	15.2	92		< 50	< 1			62																316	
Laois	25/09/2001	< 0.12	11.1	3.2	15.1	128.4	< 50	< 50	3.2	2.3	3	62.9	< 1	< 0.10	< 1	75.9	< 1	3.1	< 1	< 1	1.6	< 50	< 1	< 1	< 50	< 1		360	383
Laois	31/01/2002		10.1	3.3	13.9	117						42																336	350
Laois	11/09/2002	1.3	10.3	2.6	15.3	268						23																340	733
Laois	11/02/2003	1.1	7.9	2.1	12.5	109.7	< 50	< 50	4.8	2.2	3.6	30.8	< 1	< 0.10	< 1	89.5	< 1	4.3	< 1	< 1	2.9	< 50	< 1	< 1	< 50	< 1		329	326
Laois	18/11/2003	0.34	10.4	< 0.3	14.9	128																						329	381
Laois	04/02/2004	3.83	11.7	< 0.3	15.2	152						38																304	443
Laois	10/11/2004	3.2	11.7	2.58	13.8	120	< 50	< 50	< 1	< 1	2.04	34.7	< 1	< 0.10	< 1	102	2	4.25	< 1	< 1	9.45		< 1	< 1	< 50	< 1		337	357
Laois	15/02/2005		10.9	2.63	14.3	122	< 50	< 50	< 1	< 1	< 1	40.8	< 1	< 0.10	< 1	88.4	< 1	4.28	< 1	< 1	2.34		< 1	< 1	< 50	< 1		334	364
Laois	25/10/2005	0.7	14.2	3.06	16	126	< 50	< 50	6.51	< 1	3.39	16.3	< 1	< 0.10	< 1	87.5	< 1	4.75	< 1	< 1	< 1		< 1	< 1	< 50	< 1		336	381
Laois	01/03/2006																											375	
Louth	13/12/1995		14.72	1.31	8.75	100.24								0.2														232	255
Louth	12/08/1996		15.79	0.97	9.02	76					< 10	< 10		0.2			< 0.8											230	224
Louth	22/01/1997		18.45	2.03	10.91	90.1					20	20		0.2			< 0.8											236	250
Louth	10/09/1997	3	16.39	1.26	9.48	84.3					30	20		0.2														202	206
Louth	26/01/1998		42.6	3.65	10.95	90.7								0.2														190	220
Louth	07/09/1998	0.62	15.9	1.1	9.2	71.1								< 0.2														222	224
Louth	02/03/1999	0.8	16.29	1.16	11.33	118.3								< 0.2														220	244
Louth	08/09/1999	1.3	18.57	1.5	10.42	89.25	48.5		1.3	0.9	7.2	8.8	1.72	< 0.1		< 10	< 0.5											236	240
Louth	02/03/2000	2.5	17.66	1.36	10.07	88.97	32.4		< 0.5	1.1	7	6.7	1.32	< 0.1		< 20	< 0.5											220	252
Louth	13/09/2000	2	18.95	< 1	8.37	76.36	< 50	3.2	< 1	< 1	5.5	6.1	< 1	< 0.1	< 1	< 50	< 1	3.92	< 1	< 1	< 1	< 5	< 1	< 1	< 5	< 1	< 1	192	220
Louth	23/01/2001	0.4	26.95	< 1	10.66	81.21	92.6	< 50	< 1	< 1	4.5	7.5	< 1	< 0.1	< 1	< 50	< 1		< 1	< 1	< 1	< 5			< 5	< 1	< 1	234	224
Louth	26/09/2001	0.4	23	3.18	11.62	89.46	< 50		2.1	< 1	8.4	9.3	< 1	< 0.10		< 50	< 1	2.65										234	248
Louth	09/04/2002	0.3	18.81	1.63	10.65	86.27	< 50		< 1	< 1	10.4	6.7	< 1	< 0.10		< 50	< 1	2.99										220	240
Louth	22/04/2002																												
Louth	18/09/2002	20.5	16.68	1.31	9.53	78.48	< 50		6.5	< 1	17.7	7.5	1.52	< 0.10		< 50	< 1	3.98										222	234
Louth	17/02/2003	0	15.83	1.96	9.3	91.44	< 50		3.7	3.2	12.1	12.8	2.14	0.5		< 50	< 1	6.84										234	226
Louth	09/02/2004	2.1	16.77	3.21	10.15	84.6	< 50		6	< 1	5.7	7.6	1.7	< 0.10		< 50	< 1	3.8										232	244
Louth	26/08/2004	1	15.64	2.75	9.25	72.35	< 50		2.2	< 1	10	8.9	< 1	< 0.10		< 50	< 1	2.91										236	254
Louth	15/02/2005	0.5	16.89	3.11	10.13	79.73	< 50		3.2	< 1	5.8	11.1	< 1	< 0.10		< 50	< 1	2.89										222	254
Louth	20/08/2005	1.4	21.03	1.63	12.38	87.66	< 50		2.7	< 1	8.3	4.9	< 1	< 0.10		< 50	< 1	3.08										212	232
Louth	06/09/2005	nm	14.46	2.69	8.92	74.24	< 50		< 1	< 1	11.6	12.2	< 1	0.4		< 50	< 1	3.2										246	248
Louth	02/02/2006	< 1.5	15.01	2.59	8.83	71.84	< 50		3.7	< 1	10.3	9.7	< 1	< 0.10		< 50	< 1	3.08										234	238

FullCounty	Sampdate	Total Diss. Solids	Sus. Solids	Calcium Hardness	Colour	Turbidity	Odour	Biological Oxygen Demand	1,1,1,2 Tetrachloro-ethane	1,1,1 Trichloro-ethane	1,1,2,2 Tetrachloro-ethane	1,1,2 Trichloro-ethane	1,1 dichloroe thane	1,1 dichloroe thene	1,2,3 Trichlorobe nzene	1,2,3 Trichloropr opane	1,2,4 Trichlorobe nzene	1,2,4 Trimethylb enzene	1,2 Dibromo-3-chloro-propane	1,2 Dibromoet hene	1,2 Dichlorob enzene	1,2 Dichloroe thane	1,2 Dichlorop ropane	1,3,5 Trimethyl-benzene	1,3 Dichlorob enzene	1,3 Dichlorop ropane	1,4 Dichlorobe nzene	2,2-Dichlorop ropane	2 Chlorotol uene	4 Chlorotol uene
		mg/l $CaCO_2$	mg/l $CaCO_2$	mg/l	mg/l	mg/l C	mg/l $CaCO_2$	mg/l $CaCO_3$	mg/l O_2				μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	μg/l
				TDS	*SS*	*TIC*			*BOD*	*S_CODE*			*1112tCEa*	*111tClEa*	*1122tCEa*	*112tClEa*	*11dClEa*	*11dClEe*	*123tClBz*	*123tClPa*	*124tClBz*	*124tMyBz*	*12dB3CPa*	*12dBrEe*	*12dClBze*	*12dClEa*	*12dClPa*	*135tMyBz*	*13dClBze*	*13dClPa*
Louth	16/09/1997		2																											
Louth	04/02/1998		2																											
Louth	07/09/1998		1																											
Louth	02/02/1999		0																											
Louth	08/09/1999	421			0	0																								
Louth	02/03/2000				3																									
Louth	25/10/2000	370			3	0																								
Louth	23/01/2001	274			3	0																								
Louth	26/09/2001	395			4	0																								
Louth	09/04/2002	436			4	0																								
Louth	18/09/2002	nm			< 7	0																								
Louth	17/02/2003	nm			< 7	0																								
Louth	20/08/2003	420			15	0																								
Louth	09/02/2004	408			< 5	< 1			< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	nm	< 0.1	< 0.1
Louth	26/08/2004	416			< 5	< 1																								
Louth	15/02/2005	399			< 5	< 1																								
Louth	06/09/2005	372			< 5	< 1																								
Louth	02/02/2006	375			< 5	< 1																								
Carlow	14/11/2000		Not Vis.	123	5		1																							
Carlow	01/10/2001				10	0.4	1		< 0.1	< 0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carlow	05/03/2002				5	0.9	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	10/10/2002				5	0.3	1																							
Carlow	12/02/2003				< 5	0.3	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	22/09/2003				< 5	nm	nm		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	26/02/2004				< 5	0.5	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	05/10/2004				54	3.1			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	09/03/2005				< 5	0.5																								
Carlow	07/11/2005				< 5	0.6	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	02/05/2006				< 5	0.3	1																							
Louth	12/08/1996		1																											
Louth	11/02/1997		0																											
Louth	10/09/1997		4						< 0.1	55.522	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Louth	09/10/1997								< 0.1	25.65	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Louth	26/01/1998		2						< 0.1	24.4	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Louth	07/10/1998		0																											
Louth	02/03/1999		0																											
Louth	25/08/1999		0																											
Louth	08/09/1999	520			0	0																								
Louth	18/02/2000				11																									
Louth	06/09/2000	527			0	0																								
Louth	14/02/2001	475			1	0																								
Louth	18/09/2001	472			3	0																								
Louth	09/04/2002	473			7	0																								
Louth	21/08/2002	nm			< 7	0																								
Louth	25/02/2003	465			< 7	0																								
Louth	22/09/2003	440			< 7	0																								
Louth	27/01/2004	435			< 5	nm			< 0.1	16.727	< 0.1	< 0.1	nm	7.549	< 0.1	nm	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	nm	< 0.1	< 0.1
Louth	15/09/2004	470			6	< 1																								
Louth	15/02/2005	455			< 5	< 1																								
Louth	01/09/2005	466			< 5	< 1																								
Louth	02/02/2006	439			5	< 1																								
Kerry	13/12/1995																													
Kerry	21/08/1996																													
Kerry	04/12/1996																													
Kerry	18/08/1997																													
Kerry	03/12/1997																													
Kerry	07/09/1998																													
Kerry	12/01/1999																													
Kerry	23/08/1999																													
Kerry	09/02/2000																													
Kerry	06/09/2000																													
Kerry	24/01/2001																													
Kerry	26/09/2001																													
Kerry	29/01/2002																													

FullCounty	Sampdate	Total Diss. Solids	Sus. Solids	Calcium Hardness	Colour	Turbidity	Odour	Biological Oxygen Demand	1,1,1,2 Tetrachloro-ethane	1,1,1 Trichloro-ethane	1,1,2,2 Tetrachloro-ethane	1,1,2 Trichloro-ethane	1,1 dichloroethane	1,1 dichloroethene	1,2,3 Trichlorobenzene	1,2,3 Trichloropropane	1,2,4 Trichlorobenzene	1,2,4 Trimethylbenzene	1,2 Dibromo-3-chloro-propane	1,2 Dibromoethene	1,2 Dichlorobenzene	1,2 Dichloroethane	1,2 Dichloropropane	1,3,5 Trimethyl-benzene	1,3 Dichlorobenzene	1,3 Dichloropropane	1,4 Dichlorobenzene	2,2-Dichloropropane	2 Chlorotoluene	4 Chlorotoluene
		mg/l $CaCO_3$	mg/l $CaCO_3$	mg/l	mg/l	mg/l C	mg/l $CaCO_3$	mg/l $CaCO_3$	mg/l O_2				µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				TDS	*SS*	*TIC*			*BOD*	*S_CODE*			*1112tCEa*	*111tClEa*	*1122tCEa*	*112tClEa*	*11dClEa*	*11dClEe*	*123tClBz*	*123tClPa*	*124tClBz*	*124tMyBz*	*12dB3CPa*	*12dBrEe*	*12dClBze*	*12dClEa*	*12dClPa*	*135tMyBz*	*13dClBze*	*13dClPa*
Kilkenny	08/01/1996				5	0.2	1																							
Kilkenny	01/09/1997			64	60	27	1																							
Kilkenny	17/02/1999			273	10	1.5																								
Kilkenny	26/09/2000			295	5		1		< 0.1	< 0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2			< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kilkenny	12/02/2001					0.1																								
Kilkenny	27/09/2001				5	0.9	nm		< 0.1	< 0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kilkenny	28/02/2002				5	0.1	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	14/10/2002				< 5	0.1																								
Kilkenny	18/02/2003				< 5	0.1	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	25/09/2003				5	0.5	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	24/02/2004				5	0.3			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	11/10/2004				< 5	0.5	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	07/03/2005				< 5	0.5			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	08/11/2005				5	0.1	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	22/08/1996																													
Laois	21/11/1996																													
Laois	03/11/1997																													
Laois	12/02/1998																													
Laois	24/09/1998																													
Laois	02/02/1999																													
Laois	07/09/1999			332	< 5	0.4																								
Laois	18/01/2000				5	0.11	1																							
Laois	29/08/2000	< 0.1		333	5		1																							
Laois	23/01/2001																													
Laois	25/09/2001				10	0.4	1		< 0.1	< 0.4	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Laois	31/01/2002				5	0.2	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	11/09/2002				5	0.2	1																							
Laois	11/02/2003				< 5	0.2	1																							
Laois	18/11/2003				< 5	0.2	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	04/02/2004				< 5	0.3	1																							
Laois	10/11/2004				< 5	0.2	1		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5		< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	15/02/2005				< 5	0.4			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	25/10/2005				5	0.6			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	01/03/2006				< 5	0.2			< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Louth	13/12/1995		1																											
Louth	12/08/1996		0																											
Louth	22/01/1997																													
Louth	10/09/1997		0																											
Louth	26/01/1998		0																											
Louth	07/09/1998		0																											
Louth	02/03/1999		0																											
Louth	08/09/1999	316			0	0																								
Louth	02/03/2000				3																									
Louth	13/09/2000	278			0	0																								
Louth	23/01/2001	202			2	0																								
Louth	26/09/2001	323			4	0																								
Louth	09/04/2002	303			4	0																								
Louth	22/04/2002																													
Louth	18/09/2002	nm			< 7	0																								
Louth	17/02/2003	nm			< 7	6																								
Louth	09/02/2004	376			< 5	1			< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	nm	< 0.1	< 0.1
Louth	26/08/2004	315			6	< 1																								
Louth	15/02/2005	333			< 5	< 1																								
Louth	20/08/2005	308			14	1																								
Louth	06/09/2005	301			< 5	< 1																								
Louth	02/02/2006	309			< 5	< 1																								

FullCounty	Sampdate	4-Isopropyltoluene	Bromobenzene	Bromochloro-methane	Bromodi-chloromethane	Bromoform	Bromomethane	c-1,2 Dichloroethene	c-1,3-Dichloropropene	Carbon Tetra-chloride	Chloro-benzene	Chloroform	Dibromochloromethane	Dibromomethane	Dichloro-difluoromethane	Ethylbenzene	Hexachlorobutadiene (HCBD)	Isopropylbenzene	m&p Xylene	Methylene Chloride	n-Butyl-benzene	n-Propyl-benzene	Naphthalene	o-Xylene
		µg/l 14dClBze	µg/l 22dClPa	µg/l 2ClTole	µg/l 4ClTole	µg/l 4IsoPTol	µg/l BrBze	µg/l BrChMa	µg/l BrdClMa	µg/l Brform	µg/l BrMa	µg/l c12dClEe	µg/l c13dClPe	µg/l C-TetCl	µg/l ClBze	µg/l Clform	µg/l dBrClMa	µg/l dBrMa	µg/l dCldFMa	µg/l EthBze	µg/l HCBD	µg/l IsoPBze	µg/l mpXylene	µg/l Mtyle-Cl
Louth	16/09/1997																							
Louth	04/02/1998																							
Louth	07/09/1998																							
Louth	02/02/1999																							
Louth	08/09/1999																							
Louth	02/03/2000																							
Louth	25/10/2000																							
Louth	23/01/2001																							
Louth	26/09/2001																							
Louth	09/04/2002																							
Louth	18/09/2002																							
Louth	17/02/2003																							
Louth	20/08/2003																							
Louth	09/02/2004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1
Louth	26/08/2004																							
Louth	15/02/2005																							
Louth	06/09/2005																							
Louth	02/02/2006																							
Carlow	14/11/2000																							
Carlow	01/10/2001	< 0.1	< 0.1	< 0.1	0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carlow	05/03/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	10/10/2002																							
Carlow	12/02/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	22/09/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	26/02/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	05/10/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	09/03/2005																							
Carlow	07/11/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carlow	02/05/2006																							
Louth	12/08/1996																							
Louth	11/02/1997																							
Louth	10/09/1997	< 0.1	< 0.1		0.19	< 0.1			< 0.1	4.62	< 0.1	1.19	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Louth	09/10/1997	< 0.1	< 0.1		0.1	< 0.1			< 0.1	< 0.1	< 0.1	0.89	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Louth	26/01/1998	< 0.1	< 0.1		< 0.1	< 0.1			< 0.1	< 0.01	< 0.1	1.35	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1
Louth	07/10/1998																							
Louth	02/03/1999																							
Louth	25/08/1999																							
Louth	08/09/1999																							
Louth	18/02/2000																							
Louth	06/09/2000																							
Louth	14/02/2001																							
Louth	18/09/2001																							
Louth	09/04/2002																							
Louth	21/08/2002																							
Louth	25/02/2003																							
Louth	22/09/2003																							
Louth	27/01/2004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	0.801	< 0.1	< 0.1	< 0.1	1.295	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1
Louth	15/09/2004																							
Louth	15/02/2005																							
Louth	01/09/2005																							
Louth	02/02/2006																							
Kerry	13/12/1995																							
Kerry	21/08/1996																							
Kerry	04/12/1996																							
Kerry	18/08/1997																							
Kerry	03/12/1997																							
Kerry	07/09/1998																							
Kerry	12/01/1999																							
Kerry	23/08/1999																							
Kerry	09/02/2000																							
Kerry	06/09/2000																							
Kerry	24/01/2001																							
Kerry	26/09/2001																							
Kerry	29/01/2002																							

FullCounty	Sampdate	4-Isopropyltoluene	Bromobenzene	Bromochloro-methane	Bromodi-chloromethane	Bromoform	Bromomethane	c-1,2 Dichloroethene	c-1,3-Dichloropropene	Carbon Tetra-chloride	Chloro-benzene	Chloroform	Dibromochloromethane	Dibromomethane	Dichloro-difluoromethane	Ethylbenzene	Hexachlorobutadiene (HCBD)	Isopropylbenzene	m&p Xylene	Methylene Chloride	n-Butyl-benzene	n-Propyl-benzene	Naphthalene	o-Xylene
		µg/l 14dClBze	µg/l 22dClPa	µg/l 2ClTole	µg/l 4ClTole	µg/l 4IsoPTol	µg/l BrBze	µg/l BrChMa	µg/l BrdClMa	µg/l Brform	µg/l BrMa	µg/l c12dClEe	µg/l c13dClPe	µg/l C-TetCl	µg/l ClBze	µg/l Clform	µg/l dBrClMa	µg/l dBrMa	µg/l dCldFMa	µg/l EthBze	µg/l HCBD	µg/l IsoPBze	µg/l mpXylene	µg/l Mtyle-Cl
Kilkenny	08/01/1996																							
Kilkenny	01/09/1997																							
Kilkenny	17/02/1999																							
Kilkenny	26/09/2000		< 0.1	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1	0.601	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kilkenny	12/02/2001															< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kilkenny	27/09/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Kilkenny	28/02/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	14/10/2002																							
Kilkenny	18/02/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	25/09/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	24/02/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	11/10/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	07/03/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Kilkenny	08/11/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	0.7	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	22/08/1996																							
Laois	21/11/1996																							
Laois	03/11/1997																							
Laois	12/02/1998																							
Laois	24/09/1998																							
Laois	02/02/1999																							
Laois	07/09/1999																							
Laois	18/01/2000																							
Laois	29/08/2000																							
Laois	23/01/2001															< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Laois	25/09/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Laois	31/01/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	nm	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	11/09/2002																							
Laois	11/02/2003																							
Laois	18/11/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	04/02/2004																							
Laois	10/11/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5		< 0.5	< 0.5		< 0.5
Laois	15/02/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	25/10/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Laois	01/03/2006	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Louth	13/12/1995																							
Louth	12/08/1996																							
Louth	22/01/1997																							
Louth	10/09/1997																							
Louth	26/01/1998																							
Louth	07/09/1998																							
Louth	02/03/1999																							
Louth	08/09/1999																							
Louth	02/03/2000																							
Louth	13/09/2000																							
Louth	23/01/2001																							
Louth	26/09/2001																							
Louth	09/04/2002																							
Louth	22/04/2002																							
Louth	18/09/2002																							
Louth	17/02/2003																							
Louth	09/02/2004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1	< 0.1	< 0.1	< 0.1
Louth	26/08/2004																							
Louth	15/02/2005																							
Louth	20/08/2005																							
Louth	06/09/2005																							
Louth	02/02/2006																							

FullCounty	Sampdate	s-Butylbenzene	t-1,2 Dichloro-ethene	t-1,3-Dichloro-propene	t-Butylbenzene	Tetrachloro-ethene	Trichloro ethene	Trichlorofluoromethane	Vinyl Chloride	Benzene	Styrene	1,2 Dibromoethane	Penta-chloro-benzene	Alpha-HCH	Hexachloro-benzene	Beta-HCH	Lindane (Gamma-HCH)	Delta-HCH	Diazinon	Heptachlor	Malathion	Aldrin	Parathion
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
		nButBze	*nPBze*	*Nap-ene*	*oXylene*	*sButBze*	*t12dClEe*	*t13dClPe*	*tButBze*	*tetClEe*	*triClEe*	*tClFMa*	*Vinyl-Cl*	*Bze*	*Styrene*	*12dBrEa*	*achlorobenz*	*A-HCH*	*HCB*	*B-HCH*	*Lindane*	*D-HCH*	*DiAzOn*
Louth	16/09/1997																						
Louth	04/02/1998																						
Louth	07/09/1998																						
Louth	02/02/1999																						
Louth	08/09/1999																						
Louth	02/03/2000																						
Louth	25/10/2000																						
Louth	23/01/2001																						
Louth	26/09/2001																						
Louth	09/04/2002																						
Louth	18/09/2002																						
Louth	17/02/2003																						
Louth	20/08/2003																						
Louth	09/02/2004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	nm	< 0.1	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Louth	26/08/2004																						
Louth	15/02/2005																						
Louth	06/09/2005																						
Louth	02/02/2006																						
Carlow	14/11/2000																						
Carlow	01/10/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1													
Carlow	05/03/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Carlow	10/10/2002																						
Carlow	12/02/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Carlow	22/09/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Carlow	26/02/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Carlow	05/10/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Carlow	09/03/2005																						
Carlow	07/11/2005	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5			< 0.5													
Carlow	02/05/2006																						
Louth	12/08/1996																						
Louth	11/02/1997																						
Louth	10/09/1997	< 0.1	1.91	< 0.1	< 0.1	2.76				0.11	< 0.1	< 0.1		< 10.0		< 10.0	< 10.0	< 10.0	< 10.0			< 10.0	< 10.0
Louth	09/10/1997	< 0.1	1.11	< 0.1	< 0.1	2.57				< 0.1	< 0.1	< 0.1											
Louth	26/01/1998	< 0.1	0.75	< 0.1	< 0.1	1.98				< 0.1	< 0.1	< 0.1											
Louth	07/10/1998																						
Louth	02/03/1999																						
Louth	25/08/1999																						
Louth	08/09/1999																						
Louth	18/02/2000																						
Louth	06/09/2000																						
Louth	14/02/2001																						
Louth	18/09/2001																						
Louth	09/04/2002																						
Louth	21/08/2002																						
Louth	25/02/2003																						
Louth	22/09/2003																						
Louth	27/01/2004	< 0.1	< 0.1	< 0.1	< 0.1	2.297	14.863	nm	nm	< 0.1	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Louth	15/09/2004																						
Louth	15/02/2005																						
Louth	01/09/2005																						
Louth	02/02/2006																						
Kerry	13/12/1995																						
Kerry	21/08/1996																						
Kerry	04/12/1996																						
Kerry	18/08/1997																						
Kerry	03/12/1997																						
Kerry	07/09/1998																						
Kerry	12/01/1999																						
Kerry	23/08/1999																						
Kerry	09/02/2000																						
Kerry	06/09/2000																						
Kerry	24/01/2001																						
Kerry	26/09/2001																						
Kerry	29/01/2002																						

FullCounty	Sampdate	s-Butylbenzene	t-1,2 Dichloro-ethene	t-1,3-Dichloro-propene	t-Butylbenzene	Tetrachloro-ethene	Trichloro ethene	Trichlorofluoromethane	Vinyl Chloride	Benzene	Styrene	1,2 Dibromoethane	Penta-chloro-benzene	Alpha-HCH	Hexachloro-benzene	Beta-HCH	Lindane (Gamma-HCH)	Delta-HCH	Diazinon	Heptachlor	Malathion	Aldrin	Parathion
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
		nButBze	*nPBze*	*Nap-ene*	*oXylene*	*sButBze*	*t12dClEe*	*t13dClPe*	*tButBze*	*tetClEe*	*triClEe*	*tClFMa*	*Vinyl-Cl*	*Bze*	*Styrene*	*12dBrEa*	*achlorobenz*	*A-HCH*	*HCB*	*B-HCH*	*Lindane*	*D-HCH*	*DiAzOn*
Kilkenny	08/01/1996																						
Kilkenny	01/09/1997																						
Kilkenny	17/02/1999																						
Kilkenny	26/09/2000	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	< 0.1											
Kilkenny	12/02/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1															
Kilkenny	27/09/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1													
Kilkenny	28/02/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	14/10/2002																						
Kilkenny	18/02/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	25/09/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	24/02/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	11/10/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	07/03/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Kilkenny	08/11/2005	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5			< 0.5													
Laois	22/08/1996																						
Laois	21/11/1996																						
Laois	03/11/1997																						
Laois	12/02/1998																						
Laois	24/09/1998																						
Laois	02/02/1999																						
Laois	07/09/1999																						
Laois	18/01/2000																						
Laois	29/08/2000																						
Laois	23/01/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1															
Laois	25/09/2001	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	< 0.1													
Laois	31/01/2002	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	nm	< 0.5													
Laois	11/09/2002																						
Laois	11/02/2003																						
Laois	18/11/2003	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Laois	04/02/2004																						
Laois	10/11/2004	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Laois	15/02/2005	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5													
Laois	25/10/2005	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5			< 0.5													
Laois	01/03/2006	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5			< 0.5													
Louth	13/12/1995																						
Louth	12/08/1996																						
Louth	22/01/1997																						
Louth	10/09/1997																						
Louth	26/01/1998																						
Louth	07/09/1998																						
Louth	02/03/1999																						
Louth	08/09/1999																						
Louth	02/03/2000																						
Louth	13/09/2000																						
Louth	23/01/2001																						
Louth	26/09/2001																						
Louth	09/04/2002																						
Louth	22/04/2002																						
Louth	18/09/2002																						
Louth	17/02/2003																						
Louth	09/02/2004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	nm	nm	< 0.1	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01
Louth	26/08/2004																						
Louth	15/02/2005																						
Louth	20/08/2005																						
Louth	06/09/2005																						
Louth	02/02/2006																						

FullCounty	Sampdate	Heptachlor Epox	Endosulphan I	Dieldrin	4,4-DDE	Endrin	Endosulphan II	4,4-DDD	Endrin Aldehyde	4,4-DDT	Endrin Ketone	Metho-xychlor	Carbophenothion	Alpha-Chlordane	Gamma-Chlordane	Chloropyriphos	1,2 Dichlorobenzene d	1,1 Dichloropropene	p-Isopropyltoluene	Toluene	Trichlorobenzene	1,1,1 Trichloroethene	1,2,3 Trimethylbenzene
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l							
		HeptChl	*MalThion*	*Aldrin*	*ParThion*	*HepChlEx*	*EnSan 1*	*DiEld*	*pp-DDE*	*Edr*	*EnSan 2*	*pp-DDD*	*EdrAlde*	*pp-DDT*	*EdrKet*	*MetOxChl*	*Phenol*	*135-TCB*	*2mthPnl*	*3mthPnl*	*4mthPnl*	*24dClPnl*	*26dClPnl*
Louth	16/09/1997																						
Louth	04/02/1998																						
Louth	07/09/1998																						
Louth	02/02/1999																						
Louth	08/09/1999																						
Louth	02/03/2000																						
Louth	25/10/2000																						
Louth	23/01/2001																						
Louth	26/09/2001																						
Louth	09/04/2002																						
Louth	18/09/2002																						
Louth	17/02/2003																						
Louth	20/08/2003																						
Louth	09/02/2004	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01											
Louth	26/08/2004																						
Louth	15/02/2005																						
Louth	06/09/2005																						
Louth	02/02/2006																						
Carlow	14/11/2000																						
Carlow	01/10/2001																						
Carlow	05/03/2002																						
Carlow	10/10/2002																						
Carlow	12/02/2003																						
Carlow	22/09/2003																						
Carlow	26/02/2004																						
Carlow	05/10/2004																						
Carlow	09/03/2005																						
Carlow	07/11/2005																						
Carlow	02/05/2006																						
Louth	12/08/1996																						
Louth	11/02/1997																						
Louth	10/09/1997			< 10.0						< 10.0	< 10.0		< 10.0	< 10.0	< 10.0	< 10.0				< 0.1	< 0.1	29.6	< 0.1
Louth	09/10/1997																			< 0.1	< 0.1	< 10	< 0.1
Louth	26/01/1998																			< 0.1	< 0.1	15.24	< 0.1
Louth	07/10/1998																						
Louth	02/03/1999																						
Louth	25/08/1999																						
Louth	08/09/1999																						
Louth	18/02/2000																						
Louth	06/09/2000																						
Louth	14/02/2001																						
Louth	18/09/2001																						
Louth	09/04/2002																						
Louth	21/08/2002																						
Louth	25/02/2003																						
Louth	22/09/2003																						
Louth	27/01/2004	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01											
Louth	15/09/2004																						
Louth	15/02/2005																						
Louth	01/09/2005																						
Louth	02/02/2006																						
Kerry	13/12/1995																						
Kerry	21/08/1996																						
Kerry	04/12/1996																						
Kerry	18/08/1997																						
Kerry	03/12/1997																						
Kerry	07/09/1998																						
Kerry	12/01/1999																						
Kerry	23/08/1999																						
Kerry	09/02/2000																						
Kerry	06/09/2000																						
Kerry	24/01/2001																						
Kerry	26/09/2001																						
Kerry	29/01/2002																						

FullCounty	Sampdate	Heptachlor Epox	Endosulphan I	Dieldrin	4,4-DDE	Endrin	Endosulphan II	4,4-DDD	Endrin Aldehyde	4,4-DDT	Endrin Ketone	Metho-xychlor	Carbophenothion	Alpha-Chlordane	Gamma-Chlordane	Chloropyriphos	1,2 Dichlorobenzene d	1,1 Dichloropropene	p-Isopropyltoluene	Toluene	Trichlorobenzene	1,1,1 Trichloroethene	1,2,3 Trimethylbenzene
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l							
		HeptChl	*MalThion*	*Aldrin*	*ParThion*	*HepChlEx*	*EnSan 1*	*DiEld*	*pp-DDE*	*Edr*	*EnSan 2*	*pp-DDD*	*EdrAlde*	*pp-DDT*	*EdrKet*	*MetOxChl*	*Phenol*	*135-TCB*	*2mthPnl*	*3mthPnl*	*4mthPnl*	*24dClPnl*	*26dClPnl*
Kilkenny	08/01/1996																						
Kilkenny	01/09/1997																						
Kilkenny	17/02/1999																						
Kilkenny	26/09/2000																< 0.1	< 0.1	< 0.1	< 0.1			< 0.1
Kilkenny	12/02/2001																						
Kilkenny	27/09/2001																						
Kilkenny	28/02/2002																						
Kilkenny	14/10/2002																						
Kilkenny	18/02/2003																						
Kilkenny	25/09/2003																						
Kilkenny	24/02/2004																						
Kilkenny	11/10/2004																						
Kilkenny	07/03/2005																						
Kilkenny	08/11/2005																						
Laois	22/08/1996																						
Laois	21/11/1996																						
Laois	03/11/1997																						
Laois	12/02/1998																						
Laois	24/09/1998																						
Laois	02/02/1999																						
Laois	07/09/1999																						
Laois	18/01/2000																						
Laois	29/08/2000																						
Laois	23/01/2001																						
Laois	25/09/2001																						
Laois	31/01/2002																						
Laois	11/09/2002																						
Laois	11/02/2003																						
Laois	18/11/2003																						
Laois	04/02/2004																						
Laois	10/11/2004																						
Laois	15/02/2005																						
Laois	25/10/2005																						
Laois	01/03/2006																						
Louth	13/12/1995																						
Louth	12/08/1996																						
Louth	22/01/1997																						
Louth	10/09/1997																						
Louth	26/01/1998																						
Louth	07/09/1998																						
Louth	02/03/1999																						
Louth	08/09/1999																						
Louth	02/03/2000																						
Louth	13/09/2000																						
Louth	23/01/2001																						
Louth	26/09/2001																						
Louth	09/04/2002																						
Louth	22/04/2002																						
Louth	18/09/2002																						
Louth	17/02/2003																						
Louth	09/02/2004	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01											
Louth	26/08/2004																						
Louth	15/02/2005																						
Louth	20/08/2005																						
Louth	06/09/2005																						
Louth	02/02/2006																						

County	Site Name	Sample Date	Easting	Northing	Sample Time	Sampler	pH_field	Temperature_field	Dissolved Oxygen_field_1	Dissolved Oxygen_field_2	Conductivity_field	Total Coliforms	Faecal Coliforms
Units	-	-	-	-	-	-	pH	°C	% Sat	mg/l O_2	uS/cm	No./100ml	No./100ml
Limits of Detection	-	-	-	-	-	-	-	-	-	-	-	cfu/100ml	cfu/100ml
Method of Analysis	-	-	-	-	-	-	WQMP Multiparameter Water Quality Meter	WQMP Multiparameter Water Quality Meter	WQMP Multiparameter Water Quality Meter	WQMP Multiparameter Water Quality Meter	WQMP Multiparameter Water Quality Meter	-	-
Drinking Water Standard	-	-	-	-			**6.5-9.5**				**2500**	**0**	**0**
Louth	Ballymakenny	08/08/2007	309118	277108	-	JQ	7.4	11.9	65	6.1	650	**27**	<1
Louth	Ballymakenny	05/09/2007	309118	277108	-	JQ	7.26	10.9	44.3	-	680	**3**	<1
Louth	Ballymakenny	24/10/2007	309118	277108	11:15	JQ	-	-	-	-	-	<1	<1
Louth	Ballymakenny	03/12/2007	309118	277108	12:12	EM	7.03	11.84	40.1	4.3	508	<1	<1
Louth	Ballymakenny	07/01/2008	309118	277108	13:11	EM	7.12	11.81	-	-	493	<1	<1
Louth	Ballymakenny	03/10/2007	309118	277108	09:15	JQ	7.31	11.89	66	6.91	680	<1	<1
Louth	Drybridge	08/08/2007	306122	276033	-	JQ	7.2	10.81	90.1	8.6	630	**320**	**21**
Louth	Drybridge	05/09/2007	306122	276033	-	JQ	7.3	12.01	64.8	7.01	637	**56**	**3**
Louth	Drybridge	24/10/2007	306122	276033	-	JQ	-	-	-	-	-	-	-
Louth	Drybridge	03/12/2007	306122	276033	-	EM	-	-	-	-	-	-	-
Louth	Drybridge	07/01/2008	306122	276033	9:15	EM	6.71	10.38	-	-	623	<1	<1
Louth	Drybridge	03/10/2007	306122	276033	13:30	JQ	7.1	10.99	50.7	5.05	669	<1	<1
Laois	Portlaoise WS (Meelick BH)	15/08/2007	247899	197078	-	-	7.38	11.41	80.2	8.51	809	<1	<1
Laois	Portlaoise WS (Meelick BH)	18/09/2007	247899	197078	-	PD	7.86	11.76	77.7	8.42	816	<1	<1
Laois	Portlaoise WS (Meelick BH)	16/11/2007	247899	197078	-	PD	7.06	12.03	89.3	9.65	676	<1	<1
Laois	Portlaoise WS (Meelick BH)	18/12/2007	247899	197078	-	PD	-	-	-	-	-	<1	<1
Laois	Portlaoise WS (Meelick BH)	29/01/2008	247899	197078	13:00	PD	6.96	11.23	62.70	6.89	692	<1	<1
Laois	Portlaoise WS (Meelick BH)	12/10/2007	247899	197078	12:10	SB	6.96	10.89	48.4	4.86	592	<1	<1

County	Site Name	Sample Date	pH_Laboratory	Conductivity_Laboratory	Alkalinity	Total Hardness	Colour	Turbidity	Ammonium	Nitrite as NO_2	Nitrate as NO_3	Nitrate as N	Total Phosphorus
Units	-	-	pH	uS/cm (at 25oC)	mg/l $CaCO_3$	mg/l $CaCO_3$	Hazen	NTU	mg/l N	mg/l	mg/l	-	mg/l P
Limits of Detection	-	-	0.01pH units	14mS/cm	1mg/l	1mg/l	Hazen Units	0.1 NTU	0.01mg/l	0.05mg/l	0.3mg/l	-	0.01mg/l
Method of Analysis	-	-	pH meter	Conductivity meter	Titration	ICP MS	Visual	Meter	Spectrophotometric	Spectrophotometric	Spectrophotometric	calculated from Nitrate as NO_3	ICP OES
Drinking Water Standard	-	-	**6.5-9.5**	**2500**			***acceptable to consumer***	**1**	**0.233**	**0.15**	**50**		
Louth	Ballymakenny	08/08/2007	7.54	547	290	271	0	<0.1	<0.01	<0.05	1.7	0.3842	0.496
Louth	Ballymakenny	05/09/2007	7.55	545	350	275	0	0.2	0.02	<0.05	2.9	0.6554	0.779
Louth	Ballymakenny	24/10/2007	7.51	543	290	253	0	<0.1	0.02	**0.15**	3.7	0.8362	0.407
Louth	Ballymakenny	03/12/2007	7.55	538	270	246	0	<0.1	0.01	<0.05	3.3	0.7458	0.627
Louth	Ballymakenny	07/01/2008	7.54	546	300	279	1	<0.1	0.08	<0.05	4.3	0.972	0.709
Louth	Ballymakenny	03/10/2007	7.59	547	290	223	0	<0.1	0.07	<0.05	3.1	0.7006	0.696
Louth	Drybridge	08/08/2007	7.15	584	290	279	1	<0.1	0.05	<0.05	18.8	4.2488	0.583
Louth	Drybridge	05/09/2007	7.47	585	271	286	1	0.1	0.05	<0.05	18.8	4.2488	0.826
Louth	Drybridge	24/10/2007	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	03/12/2007	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	07/01/2008	7.12	927	330	216	4	0.1	0.02	<0.05	33	7.458	0.477
Louth	Drybridge	03/10/2007	7.43	596	250	215	2	<0.1	0.02	<0.05	18.1	4.0906	0.709
Laois	Portlaoise WS (Meelick BH)	15/08/2007	7.46	764	370	390	0	<0.1	<0.01	<0.05	19.8	4.4748	0.51
Laois	Portlaoise WS (Meelick BH)	18/09/2007	7.65	747	350	415	0	0.8	<0.01	<0.05	18.7	4.2262	0.847
Laois	Portlaoise WS (Meelick BH)	16/11/2007	7.25	754	450	480	0	<0.1	0.1	<0.05	19.5	4.407	0.814
Laois	Portlaoise WS (Meelick BH)	18/12/2007	7.71	754	340	422	1	<0.1	0.03	<0.05	17.9	4.0454	0.394
Laois	Portlaoise WS (Meelick BH)	29/01/2008	7.48	771	380	339	0	<0.1	0.02	<0.05	19	4.294	0.642
Laois	Portlaoise WS (Meelick BH)	12/10/2007	7.3	752	300	390	1	<0.1	0.02	<0.05	17.8	4.0228	0.627

County	Site Name	Sample Date	Molybdate Reactive Phosphate	Total Organic Carbon	Chloride	Fluoride	Sulphate	Sodium	Potassium	Total Magnesium	Total Calcium	Iron	Manganese	Boron
Units	-	-	mg/l P	mg/l C	mg/l Cl	mg/l F^-	mg/l SO_4	mg/l Na	mg/l K	mg/l Mg	mg/l Ca	ug/l Fe	ug/l Mn	ug/l B
Limits of Detection	-	-	0.001mg/l	2mg/l	1mg/l	0.1mg/l	3mg/l	0.2mg/l	0.2mg/l	0.05mg/l	0.05mg/l	2ug/l	1ug/l	3ug/l
Method of Analysis	-	-	Spectrophotometric	TOC Analyse	Spectrophotometric	Spectrophotometric	Spectrophotometric	Flame Photometer	Flame Photometer	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS
Drinking Water Standard	-	-		***no abnormal change***	**250**	**1.5**	**250**	**200**				**200**	**50**	**1000**
Louth	Ballymakenny	08/08/2007	0.189	<2	25	<0.1	21	19	1.7	10.15	85.84	<2	43	49
Louth	Ballymakenny	05/09/2007	0.089	<2	22	<0.1	18	17	1.6	10.13	86.45	39	42	46
Louth	Ballymakenny	24/10/2007	0.373	<2	22	0.4	16	15.5	1.4	10.45	87.11	17	45	7
Louth	Ballymakenny	03/12/2007	0.218	<2	23	0.2	17	19	1.5	10.08	88.41	62	36	32
Louth	Ballymakenny	07/01/2008	0.218	2	22	0.2	19	18.5	1.7	10.36	85.39	40	<1	39
Louth	Ballymakenny	03/10/2007	0.255	<2	23	0.2	18	16.5	1.6	9.95	85.79	18	**55**	<3
Louth	Drybridge	08/08/2007	0.09	<2	28	<0.1	16	15.5	4.6	8.17	95.67	<2	<1	24
Louth	Drybridge	05/09/2007	0.075	<2	26	<0.1	19	14.5	4.3	8.39	96.61	12	<1	28
Louth	Drybridge	24/10/2007	-	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	03/12/2007	-	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	07/01/2008	0.156	3	39	0.2	21	25.5	5.4	9.27	103.1	33	2	50
Louth	Drybridge	03/10/2007	0.109	<2	30	0.1	18	18.5	4	8.51	94.75	22	<1	<3
Laois	Portlaoise WS (Meelick BH)	15/08/2007	0.027	<2	22	<0.1	33	14	3.3	13.67	136.4	<2	<1	26
Laois	Portlaoise WS (Meelick BH)	18/09/2007	0.03	<2	25	0.2	27	13.5	3.1	12.03	120	<2	<1	5
Laois	Portlaoise WS (Meelick BH)	16/11/2007	0.031	<2	25	0.2	24	13	3.2	13.59	140.6	56	<1	29
Laois	Portlaoise WS (Meelick BH)	18/12/2007	0.042	<2	23	<0.1	31	13	3.3	14.07	136.8	35	2	26
Laois	Portlaoise WS (Meelick BH)	29/01/2008	0.039	<2	24	0.2	30	12.5	3.5	12.12	126.6	25	<1	13
Laois	Portlaoise WS (Meelick BH)	12/10/2007	<0.01	<2	25	0.3	28	15	3.3	13.4	136.7	20	<1	<3

County	Site Name	Sample Date	Aluminium	Chromium	Nickel	Copper	Zinc	Arsenic	Cadmium	Antimony	Barium	Lead	Uranium	Mercury	Cobalt	Molybdenum	Strontium	Silver	Berillium	Atrazine	MCPA	2,4-D	Isoproturon
Units	-	-	ug/l Al	ug/l Cr	ug/l Ni	ug/l Cu	ug/l Zn	ug/l As	ug/l Cd	ug/l Sb	ug/l Ba	ug/l Pb	µg/l U	ug/l Hg	µg/l Co	µg/l Mo	µg/l Sr	µg/l Ag	µg/l Be	µg/l	µg/l	µg/l	µg/l
Limits of Detection	-	-	2ug/l	1ug/l	1ug/l	1ug/l	1ug/l	1ug/l	0.4ug/l	1ug/l	1ug/l	1ug/l	1ug/l	0.05ug/l	1ug/l	1ug/l	1ug/l	2ug/l	1ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l
Method of Analysis	-	-	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	GC MS	GC MS	GC MS	HPLC
Drinking Water Standard	-	-	**200**	**50**	**20**	**2000**		**10**	**5**	**5**	**700**	**25**	**15**	**1**		**70**				**0.1**	**0.1**	**0.1**	**0.1**
Louth	Ballymakenny	08/08/2007	-	2	7	<1	6	2	1.8	2	8	<1	5	<0.05	2	<1	177	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	05/09/2007	<2	6	7	<1	14	2	1.4	2	6	5	4	<0.05	2	1	180	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	24/10/2007	<2	6	5	5	<1	1	1.4	<1	6	<1	4	<0.05	2	1	168	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	03/12/2007	<2	11	7	<1	120	2	1.6	<1	7	<1	4	<0.05	2	<1	167	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	07/01/2008	43	<1	2	7	11	<1	<0.4	<1	20	<1	<1	<0.05	<1	<1	196	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	03/10/2007	<2	5	5	<1	<1	1	1.3	<1	5	<1	3	<0.05	3	<1	146	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	08/08/2007	-	3	<1	<1	2	1	<0.4	<1	51	<1	<1	<0.05	<1	<1	161	<2	<1	0.05	0.03	<0.01	<0.01
Louth	Drybridge	05/09/2007	<2	8	3	2	10	<1	<0.4	<1	48	3	<1	<0.05	<1	<1	163	<2	<1	0.04	0.02	<0.01	<0.01
Louth	Drybridge	24/10/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	03/12/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louth	Drybridge	07/01/2008	26	<1	2	12	28	<1	<0.4	<1	222	<1	<1	<0.05	<1	<1	222	<2	<1	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	03/10/2007	<2	3	1	1	<1	<1	<0.4	<1	30	<1	<1	<0.05	<1	<1	123	<2	<1	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	15/08/2007	-	8	4	3	26	<1	<0.4	<1	100	<1	5	<0.05	<1	<1	267	<2	<1	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	18/09/2007	<2	9	2	<1	12	1	<0.4	<1	107	<1	4	<0.05	<1	<1	279	<2	<1	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	16/11/2007	27	23	3	5	34	<1	<0.4	<1	117	2	4	<0.05	<1	<1	295	<2	<1	<0.01	0.02	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	18/12/2007	12	3	9	2	245	<1	0.8	<1	106	<1	5	<0.05	<1	<1	279	<2	<1	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	29/01/2008	4	6	1	<1	26	<1	<0.4	<1	74	<1	2	<0.05	<1	<1	211	<2	<1	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	12/10/2007	<2	11	2	<1	<1	<1	<0.4	<1	98	<1	4	0.08	<1	<1	257	<2	<1	<0.01	<0.01	<0.01	<0.01

County	Site Name	Sample Date	Mecoprop	Chlortoluron	Glyphosate	Bentazone	Cypermethrin	Dieldrin	DDT	Lindane	Diuron
Units	-	-	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Limits of Detection	-	-	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l	0.01ug/l
Method of Analysis	-	-	GC MS	HPLC	GC MS	GC MS	GC MS	GC MS	GC MS	GC MS	HPLC
Drinking Water Standard	-	-	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Louth	Ballymakenny	08/08/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	05/09/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	24/10/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	03/12/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	07/01/2008	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Ballymakenny	03/10/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	08/08/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	05/09/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	24/10/2007	-	-	-	-	-	-	-	-	-
Louth	Drybridge	03/12/2007	-	-	-	-	-	-	-	-	-
Louth	Drybridge	07/01/2008	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Louth	Drybridge	03/10/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	15/08/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	18/09/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	16/11/2007	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	18/12/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	29/01/2008	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Laois	Portlaoise WS (Meelick BH)	12/10/2007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

							Parameter	Colour	Conductivity	Dissolved Oxygen	Dissolved Oxygen	ORP	pH	Specific Conductance	Temperature	Turbidity	E. coli	E.coli (presumptive)	Total Coliform
							Units	Hazen	µS/cm	% Sat.	mg/l	mV	pH	µS/cm	°C	NTU	MPN/100ml	CFU/100ml	MPN/100ml
							Drinking Water Standard	No abnormal change	2500 µS/cm								0 counts per 100ml	0 counts per 100ml	No abnormal change
Urban Area	**Sample Loc Code**	**Round No.**	**Sample I.D.**	**Sampled Date**	**Labware Ref.**	**Type**	**Duplicate details**												
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106			7.5	567	7	0.75	128.5	7.47	756	11.88	5.97	<1		129
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		WAT04-R2	5	550		1	101	7.2	743	11.42	0.39	<1		<1
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278			0	621	83	8.8	56.2	7.4	840	11.33	0.75	<1		<1
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		WAT04-R4	0	562	54	5.8	31.7	7.4	752	11.78	1.03	<1		<1
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121			0	513		0.33	100	7.16	683	12.03	1.79		<1	
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985			0	518	6	0.6	54.8	7.1	688	12.04	4.78		0	
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117			0					7.41		15.9	0.54	<1		28
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		WEX03-R2	0	29871	98	8.6	33.6	7.1	36688	15.27	0.8	15		179
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118			0					7.24		17.6	1.3	<1		12
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108			5	437		0.89	89.7	7.22		11.84	0.65	<1		18
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110			0	426		0.91	215	7.16	579	11.14	0.94	5		185
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109			5	767		1.42	-78.6	6.98	1027	11.74	0.91	<1		<1
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111			0	699		0.47	214	7.15	794	18.74	0.59	<1		<1
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983			0	404	47	5.1	143.1	7.1	539	11.85	1.92	<1		15
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981			5	406	45	4.9	627	7.1	564	10.37	0.8	<1		57
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		CAR02-R2	0	730	2	0.2	0.5	6.8	980	11.66	0.48	<1		<1
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		CAR02-R3	0	816	2	0.2	-5.3	6.7	1096	11.61	0.95	<1		<1
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982			0	552	41	4.4	238.7	7	739	11.78	0.44	<1		<1
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276			0	621	47	3.2	165.7	6.8	840	11.33	0.68	<1		<1
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		WAT04	10	1131		0.5	121.4	6.81	1296	18.34	67.2	2420		>2420
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972			0	1140		0.5	85.3	6.7	1334	17.38	1.58	>2420		>2420
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271			100	1024	31	3.4	131.9	6.6	1388	11.3	342	<10		>24196
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870			5	890	26	2.8	85.1	6.7	1190	11.9	2.26	1		>2420
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124			0	1137		0.13	-140.8	7.28	1429	14.3	1.97	<1		770
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975			0	1037	7		-100.7	7.4		13.22	2.14	<1		7
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268			70	451	18	2	Not Analysed	7.8	609	11.42	68.4	<1		23
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454			0	799	3	0.3	-116.6	7.6	1064	12.99	9.26	<1		29
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756			20	413		1.81	138.2	7.6	494	16.38	35	<1		86
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107			5	764	19.3	1.72	125.4	7.78	825	21.17	1.79	<1		<1
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122			0	486		0.08	204.7	7.18	653	11.6	0.8		<1	
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987			0	497	45	4.9	172.7	7.1	660	12.09	0.23		0	
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180			0	463		0.29	67.4	7.24		12.77	0.51	<1		1
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993			0	469	8	0.9	111.8	7.1	612	12.81	1.4	<1		22
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284			0	447	7	0.7	26.3	7.1	580	12.31	0.74	<1		<1
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879			0	475	14	1.5	54.7	7.2	609	13.4	1.6	<1		<1
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		DUB04	25	478	-	0.47	-13.5	7.2	635	12.07	12.2	1		8
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113			0	585	-	0.48	193	7.01	790	11.4	0.33	<1		<1
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		WEX03	8	491	-	0.84	9.6	7.13	654	11.95	1.64	<1		<1
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994			0	52	100	10.5	721	6.9	67	13.46	0.57	<1		2
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		WEX03-R3	0	467	45	4.9	-5.8	7	626	11.7	1.57	<1		<1
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116			5	279	-	1.7	192.6	6.69	360	13.26	0.45		<1	
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989			5	281	89	9.4	193.9	6.6	366	12.86	0.39		<1	
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280			0	306	86	9.3	163	6.3	405	12.13	0.62		5	
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876			0	288	84	8.6	142	6.7	364	14.03	0.59		0	
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119			5	249	-	1	210	6.28	330	12.23	1.19		20	
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990			0	257	32	3.4	182	6.2	341	12.11	1.06		<1	
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281			0	244	30	3.2	142.1	6.1	326	11.76	1.66		1	
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877			0	260	31	3.3	193	6.2	338	12.85	1.16		0	
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120			0	357	-	0.94	209	6.77	467	12.9	0.34		<1	
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991			0	357	7	0.7	152.7	6.7	471	12.53	0.3		<1	
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282			0	342	6	0.7	150.9	6.7	448	12.54	0.65		0	
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878			0	353	12	1.3	111.5	6.7	465	12.45	0.46		0	
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977			>100	1004	-	0.4	111.2	6.9	1311	12.81	68.3	0		3800
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872			0	1015	14	1.7	114.3	10.5	1301	13.43	8.83	0		22

							Parameter	Colour	Conductivity	Dissolved Oxygen	Dissolved Oxygen	ORP	pH	Specific Conductance	Temperature	Turbidity	E. coli	E.coli (presumptive)	Total Coliform
							Units	Hazen	µS/cm	% Sat.	mg/l	mV	pH	µS/cm	°C	NTU	MPN/100ml	CFU/100ml	MPN/100ml
							Drinking Water Standard	No abnormal change	2500 µS/cm								0 counts per 100ml	0 counts per 100ml	No abnormal change
Urban Area	**Sample Loc Code**	**Round No.**	**Sample I.D.**	**Sampled Date**	**Labware Ref.**	**Type**	**Duplicate details**												
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	DRO03-R2	0	730	2	0.2	0.5	6.8	980	11.66	0.48	<1		<1
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	DR003-R3	0	816	2	0.2	-5.3	6.7	1096	11.61	0.95	<1		<1
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	NAA01	25	478	-	0.47	-13.7	7.2	635	12.07	12.2	1		16
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	DUB01A	0	1131	-	0.5	121.4	6.81	1296	18.34	67.2	1986		>2420
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	BAL01-R2	5	550	-	1	101	7.2	743	11.42	0.39	<1		<1
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	BAL01-R4	0	562	54	5.8	31.7	7.4	752	11.78	1.03	<1		<1
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	TRA01	0	491	-	0.87	9.6	7.13	654	11.95	1.64	<1		<1
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	CRK01-02	0	29871	98	8.6	33.6	7.1	36688	15.27	0.8	12		186
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	TRA01-R3	0	467	45	4.9	-5.8	7	626	11.7	1.57	<1		<1
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank		-	-	-	-	-	-	-	-	-	8		488
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank		-	-	-	-	-	-	-	-	-	<1		1
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank		-	-	-	-	-	-	-	-	-	<1		<1
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank		-	-	-	-	-	-	-	-	-	0		0
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank		-	-	-	-	-	-	-	-	-	0		0
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank		-	-	-	-	-	-	-	-	-	0		0

Key

MPN Most Probable Number
CFU Colony Forming Unit - Plate or Direct Counts
Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG Value or standard not given

							Total Coliform (presumptive)	Ammonia	Arsenic	Chloride	Cyanide	Fluoride	Nitrate	Nitrite	Phosphorus (React)	Sulphate	T.O.C.	TON	Total Alkalinity	Total Dissolved Solids (180°C)
							CFU/100ml	mg/l as N	µg/l	mg/l	µg/l	mg/l as F	mg/l as N	mg/l as N	mg/l as P	mg/l	mg/l	mg/l as N	mgCaCO3/l	mg/l
							No abnormal change	0.3 mg/l	10 µg/l	250 mg/l	50 µg/l	1.5 mg/l	50 mg/l	0.5 mg/l		250 mg/l	No abnormal change			
Urban Area	**Sample Loc Code**	**Round No.**	**Sample I.D.**	**Sampled Date**	**Labware Ref.**	**Type**														
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106			0.01	8	44	<2	0.11	1.15	0.02	0.02	71	0.8	1.17	277	514
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979			0.01	6	37	<100	0.51	0.95	0.01	0.01	19	1.4	0.96	274	460
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278			Not Analysed	5	40	<100	0.11	1.24	0.011	0.01	75	1.5	1.25	276	460
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874			0.01	9	49	<100	0.11	1.1	0.016	0.02	73	1.3	1.12	272	480
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		<1	0.01	1	27	<2	0.18	<0.37	<0.005	<0.01	60	<0.3	<0.37	291	390
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		18	<0.01	2	25	<100	0.11	<0.37	<0.005	<0.01	60	<0.8	<0.37	286	420
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117			<0.30	< 1	348	<2	<0.10	<0.37	0.014	<0.01	1560	0.4	<0.37	112	20194
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992			0.27	< 1	13175	<100	<0.10	<0.37	0.007	0.06	1713	2.1	<0.37	123	24920
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118			<0.30	< 1	18	2	0.41	2.5	<0.005	<0.01	33	1.6	2.5	58	10
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108			0.01	1	23	<2	0.1	0.66	0.013	0.07	16	<0.3	0.67	243	322
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110			0.01	< 1	26	<2	0.08	4.32	<0.005	0.04	17	1.5	4.33	224	312
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109			0.05	1	87	<2	0.17	<0.37	<0.005	<0.01	57	2	<0.37	322	614
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111			0.01	< 1	47	12	0.11	2.31	<0.005	<0.01	40	0.5	2.32	290	556
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983			0.02	< 1	22	<100	0.11	0.69	0.009	0.06	60	<0.8	0.7	244	620
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981			0.02	< 1	29	<100	0.1	4.18	<0.005	0.03	44	1	4.18	248	380
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984			0.05	1	29	<100	0.19	<0.37	<0.005	0.02	59	1.3	<0.37	338	600
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277			0.05	2	106	<100	0.11	<0.37	<0.005	<0.01	62	1.3	<0.37	334	640
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982			0.02	< 1	24	<100	<0.10	2.34	<0.005	0.01	17	0.8	2.34	280	460
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276			0.01	< 1	49	<100	0.12	2.69	<0.005	<0.01	42	1.4	2.69	282	460
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123			0.06	1	28	<2	0.38	62.9	0.038	0.01	139	2.7	62.93	324	1234
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972			0.03	< 1	30	<100	0.12	43.65	0.026	0.04	71	3.6	43.68	354	1000
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271			0.15	10	28	<100	0.42	63.76	0.028	0.01	131	7.7	63.78	312	940
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870			<0.01	< 1	25	<100	0.45	34.94	<0.005	0.01	132	6.4	34.94	369	840
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124			0.13	< 1	139	<2	0.59	<0.37	<0.005	<0.01	273	<0.3	<0.37	292	910
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975			0.13	2	<2	<100	<0.10	<0.37	<0.005	0.01	<2	1	<0.37	320	880
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268			0.28	< 1	29	<100	0.72	<0.37	0.345	<0.01	74	1.3	0.59	180	360
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454			0.07	< 1	68	<100	0.67	0.49	0.054	<0.01	142	2.3	0.54	278	580
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756			0.01	13	21	<2	0.13	0.75	<0.005	0.03	23	1.6	0.73	200	274
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107			0.05	< 1	32	<2	0.86	<0.37	<0.005	<0.01	125	<0.3	<0.37	236	464
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<1	0.01	< 1	26	<2	<0.10	7.56	<0.005	<0.01	16	<0.3	7.57	278	388
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		0	<0.01	< 1	27	<100	<0.10	8.34	<0.005	0.03	16	<0.8	8.35	280	360
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180			0.03	< 1	21	<2	0.32	0.55	0.008	<0.01	26	<0.3	0.56	278	414
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993			0.01	< 1	29	<100	0.34	0.69	<0.005	<0.01	30	<0.8	0.7	288	440
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284			0.01	< 1	22	<100	0.29	0.89	<0.005	0.01	29	<0.8	0.89	274	320
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879			0.02	< 1	22	<100	0.29	1.37	<0.005	<0.01	33	<0.8	1.38	274	340
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112			0.13	1	14	<2	0.3	<0.37	<0.005	0.01	24	<0.3	<0.37	300	382
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113			0.01	< 1	26	<2	0.11	4.02	<0.005	0.01	38	1.4	4.03	332	474
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181			0.04	< 1	28	<2	<0.10	<0.37	0.006	<0.01	10	0.4	<0.37	312	412
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994			<0.01	< 1	14	<100	0.65	<0.37	<0.005	<0.01	2	3.3	<0.37	<10	140
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283			0.04	1	28	<100	<0.10	<0.37	0.01	0.03	11	1	<0.37	312	360
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		7	0.03	< 1	25	<2	<0.10	6.85	<0.005	0.01	43	<0.3	6.86	76	348
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		<1	<0.01	< 1	25	<100	<0.10	6.52	<0.005	<0.01	43	0.8	6.52	78	200
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		64	0.02	< 1	25	<100	<0.10	6.39	<0.005	0.01	43	<0.8	6.39	76	240
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		13	<0.01	< 1	24	<100	<0.10	6.7	0.013	0.02	44	<0.8	6.71	78	260
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		60	0.03	< 1	21	<2	<0.10	4.09	<0.005	0.01	45	<0.3	4.09	72	378
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		<1	0.01	< 1	24	<100	<0.10	3.71	<0.005	<0.01	46	1.3	3.72	68	220
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		8	0.02	< 1	25	<100	<0.10	3.46	<0.005	<0.01	45	0.8	3.46	78	220
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		1	0.11	< 1	26	<100	<0.10	3.72	<0.005	<0.01	44	1	3.72	74	120
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		1	0.01	< 1	25	<2	<0.10	2.67	<0.005	0.01	22	<0.3	2.67	184	276
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		2	0.01	< 1	26	<100	<0.10	2.49	<0.005	0.01	23	1.3	2.5	181	340
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		0	0.03	< 1	26	<100	<0.10	2.72	<0.005	<0.01	23	<0.8	2.72	184	280
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		2	0.03	< 1	25	<100	<0.10	2.56	<0.005	<0.01	23	<0.8	2.56	182	240
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977			0.02	7	<2	<100	<0.10	<0.37	<0.005	0.01	<2	1	<0.37	251	820
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872			<0.01	2	231	<100	0.11	<0.37	<0.005	0.01	71	1.2	<0.37	250	760

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Total Coliform (presumptive)	Ammonia	Arsenic	Chloride	Cyanide	Fluoride	Nitrate	Nitrite	Phosphorus (React)	Sulphate	T.O.C.	TON	Total Alkalinity	Total Dissolved Solids (180°C)
							CFU/100ml	mg/l as N	µg/l	mg/l	µg/l	mg/l as F	mg/l as N	mg/l as N	mg/l as P	mg/l	mg/l	mg/l as N	mgCaCO3/l	mg/l
							No abnormal change	0.3 mg/l	10 µg/l	250 mg/l	50 µg/l	1.5 mg/l	50 mg/l	0.5 mg/l		250 mg/l	No abnormal change			
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate		0.06	2	27	<100	<0.10	<0.37	<0.005	<0.01	16	0.8	<0.37	336	580
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate		0.06	2	98	<100	0.11	<0.37	<0.005	<0.01	62	1.3	<0.37	334	580
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate		0.13	< 1	14	<2	0.29	<0.37	<0.005	<0.01	25	<0.3	<0.37	300	388
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate		0.05	< 1	29	<2	0.4	60.88	0.041	0.01	141	2.4	60.92	322	1210
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate		0.01	7	<2	<100	<0.10	0.95	0.009	0.01	<2	1.6	0.96	275	460
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate		0.01	10	44	<100	0.11	1.08	0.016	0.1	73	1.6	1.1	274	460
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate		0.03	< 1	28	<2	<0.10	<0.37	<0.005	<0.01	10	0.3	<0.37	312	436
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate		0.26	< 1	12434	<100	<0.10	<0.37	0.008	0.05	1613	1.8	<0.37	122	24720
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate		0.03	1	28	<100	<0.10	<0.37	<0.005	<0.01	11	1	<0.37	316	400
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank		<0.01	< 1	12	<100	0.79	0.68	<0.005	0.04	19	2.2	0.69	30	60
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank		<0.01	< 1	<2	<100	<0.10	<0.37	<0.005	0.04	<2	0.9	<0.37	<10	0
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank		0.01	< 1	<2	<100	<0.10	<0.37	<0.005	0.04	<2	<0.8	<0.37	<10	40
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank		0.02	< 1	<2	<100	<0.10	<0.37	<0.005	0.04	<2	2.3	<0.37	<10	20
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank		<0.01	< 1	14	<100	0.74	1.04	<0.005	0.01	14	2.9	1.04	32	120
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank		0.25	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	<0.8	<0.37	<10	20
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank		<0.01	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	<0.8	<0.37	<10	20
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank		0.11	< 1	<2	<2	<0.10	0.42	<0.005	0.01	<4	<0.3	0.43	<10	26
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank		0.04	< 1	<2	<100	<0.10	<0.37	0.006	<0.01	<2	1	<0.37	<10	100
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank		<0.01	2	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	<0.8	<0.37	<10	20
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank		0.04	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	<0.8	<0.37	<10	240
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank		<0.01	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	1	<0.37	<10	20
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank		0.02	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	1.1	<0.37	<10	20
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank		0.01	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	<0.8	<0.37	<10	20
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank		0.02	< 1	<2	<100	<0.10	<0.37	<0.005	<0.01	<2	1.3	<0.37	<10	20

Key

MPN Most Probable Number
CFU Colony Forming Unit - Plate or Direct Counts
Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Total Hardness	Total Phosphorus	Aluminium	Antimony	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
							mgCaCO3/l	mg P/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l
									200 µg/l	5 µg/l			1 mg/l	5 µg/l		50 µg/l		2 mg/l	200 µg/l	10 µg/l
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		392	0.02	< 1	3	46	< 1	174	< 0.3	132	< 0.5	2	2	24	< 4
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		397	0.02	2	2	44	< 1	40	< 0.3	124	< 0.4	2	1	14	< 3
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		355	0.02	4	2	45	< 1	39	< 0.3	132	< 0.4	2	1	36	< 3
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		365	0.02	6	2	47	< 1	35	< 0.3	125.1	< 0.4	2	1	65	< 3
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		368	<0.01	4	< 1	7	< 1	< 32	< 0.3	103.3	< 0.5	< 1	< 0.5	28	< 4
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		386	<0.01	2	< 1	8	< 1	< 32	< 0.3	105	< 0.4	< 1	< 0.5	18	< 3
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		4244	<0.01	3	< 1	117	< 1	1886	0.8	336	1	< 1	0.9	137	< 4
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		4650	0.05	7	< 1	103	< 1	3226	0.7	326	0.9	1	< 0.5	143	< 3
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		104	0.03	22	< 1	10	< 1	< 32	< 0.3	37	0.6	< 1	< 0.5	71	< 4
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		281	0.07	4	< 1	6	< 1	< 32	1	85	< 0.5	2	< 0.5	44	< 4
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		261	0.05	3	< 1	46	< 1	< 32	< 0.3	91	0.9	< 1	3	4	< 4
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		430	<0.01	7	< 1	201	< 1	< 32	< 0.3	152	< 0.5	2	0.9	297	< 4
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		38	0.01	5	< 1	3	< 1	< 32	< 0.3	7.6	1	< 1	103	10	< 4
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		279	0.07	3	< 1	5	< 1	43	1	88	< 0.4	2	< 0.5	13	< 3
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		287	0.03	8	< 1	30	< 1	< 32	< 0.3	102	0.6	< 1	6	8	< 3
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		452	0.01	4	< 1	213	< 1	< 32	< 0.3	151	< 0.4	2	0.5	331	< 3
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		443	0.01	3	< 1	200	< 1	< 32	< 0.3	161	< 0.4	2	0.8	359	< 3
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		257	0.01	3	< 1	39	< 1	< 32	< 0.3	139	1	< 1	10	4	< 3
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		365	0.01	2	< 1	40	< 1	36	< 0.3	144	1	< 1	15	22	< 3
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		686	0.13	506	< 1	24	< 1	243	< 0.3	326.4	11	< 1	6	780	17
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		677	0.11	54	1	18	< 1	276	< 0.3	313	3	< 1	2	242	< 3
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		614	0.59	1944	1	50	< 1	272	0.4	336	5	6	16	14325	119
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		624	0.02	19	< 1	16	< 1	264	< 0.3	258.7	9	< 1	5	96	< 3
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		426	0.03	8	< 1	28	< 1	161	< 0.3	148.7	2	< 1	< 0.5	1071	< 4
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		327	<0.01	8	< 1	30	< 1	203	< 0.3	68	0.7	< 1	< 0.5	546	< 3
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		140	0.01	34	2	24	< 1	123	< 0.3	38	< 0.4	1	2	7444	4
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		154	<0.01	16	< 1	34	< 1	221	< 0.3	37	2	< 1	< 0.5	677	< 3
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		233	4.03	36	< 1	53	< 1	< 32	0.5	77.7	3	2	10	7674	10
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		299	<0.01	< 1	< 1	49	< 1	39	< 0.3	77.1	< 0.5	< 1	2	68	< 4
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		350	<0.01	6	< 1	1	< 1	< 32	< 0.3	97.4	0.9	< 1	< 0.5	6	< 4
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		345	<0.01	1	< 1	< 1	< 1	< 32	< 0.3	99	0.9	< 1	< 0.5	3	< 3
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		310	<0.01	< 1	< 1	67	< 1	35	< 0.3	86	< 0.5	< 1	3	32	< 4
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		380	<0.01	7	< 1	64	< 1	69	< 0.3	88	< 0.4	< 1	4	41	< 3
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		310	<0.01	7	< 1	68	< 1	41	< 0.3	90	< 0.4	< 1	16	57	< 3
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		321	<0.01	8	< 1	66	< 1	51	< 0.3	92	< 0.4	< 1	15	54	< 3
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		327	<0.01	44	< 1	287	< 1	< 32	< 0.3	105.4	0.5	< 1	1	659	< 4
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		405	<0.01	< 1	< 1	97	< 1	40	< 0.3	147.5	< 0.5	< 1	3	2	< 4
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		330	0.01	4	< 1	14	< 1	< 32	< 0.3	148	< 0.5	3	< 0.5	466	< 4
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		44	<0.01	31	< 1	1	< 1	< 32	< 0.3	5	< 0.4	< 1	6	23	< 3
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		330	<0.01	13	< 1	16	< 1	< 32	< 0.3	146	< 0.4	3	< 0.5	415	< 3
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		149	0.02	< 1	< 1	< 1	< 1	1897	< 0.3	43.3	< 0.5	< 1	0.8	2	< 4
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		134	0.02	4	< 1	< 1	< 1	44	< 0.3	43	< 0.4	< 1	0.6	2	< 3
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		134	0.02	3	< 1	< 1	< 1	51	< 0.3	44	0.4	< 1	0.8	8	< 3
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		141	0.02	13	< 1	< 1	< 1	48	0.3	44	0.9	< 1	0.6	8	< 3
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		127	0.02	24	< 1	27	< 1	40	< 0.3	28.3	0.6	< 1	9	164	< 4
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		144	0.02	44	< 1	33	< 1	< 32	< 0.3	29	5	3	7959	969	3
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		120	0.02	31	< 1	30	< 1	< 32	< 0.3	30	< 0.4	< 1	2	19	< 3
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		128	0.02	22	< 1	28	< 1	< 32	< 0.3	28	3	< 1	438	181	< 3
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		213	0.02	3	< 1	37	< 1	< 32	< 0.3	66.8	< 0.5	< 1	2	2	< 4
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		250	0.01	2	< 1	35	< 1	< 32	< 0.3	66	< 0.4	< 1	4	32	5
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		210	0.02	1	< 1	35	< 1	< 32	< 0.3	66	0.7	< 1	3	15	4
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		232	0.01	2	< 1	35	< 1	< 32	< 0.3	65	< 0.4	< 1	7	11	< 3
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		465	0.06	31	< 1	175	< 1	52	< 0.3	140	2	4	99	5997	< 3
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		470	0.02	33	< 1	157	< 1	51	< 0.3	138.3	3	1	61	1188	< 3

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Total Hardness	Total Phosphorus	Aluminium	Antimony	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
							mgCaCO3/l	mg P/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l
									200 µg/l	5 µg/l			1 mg/l	5 µg/l		50 µg/l		2 mg/l	200 µg/l	10 µg/l
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	480	0.01	4	< 1	213	< 1	< 32	< 0.3	153	< 0.4	2	0.5	313	< 3
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	445	0.01	3	< 1	207	< 1	41	< 0.3	153	< 0.4	2	0.8	418	< 3
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	323	0.01	43	< 1	274	< 1	< 32	< 0.3	105.6	< 0.5	< 1	1	626	< 4
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	682	0.13	439	< 1	24	< 1	242	< 0.3	316.9	12	< 1	5	706	14
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	415	0.02	4	3	44	< 1	55	< 0.3	152	< 0.4	2	1	23	< 3
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	367	0.02	5	3	47	< 1	37	< 0.3	121.6	< 0.4	2	1	47	< 3
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	336	0.02	6	< 1	14	< 1	< 32	< 0.3	137	< 0.5	2	< 0.5	417	< 4
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	4525	0.05	3	< 1	103	< 1	3300	0.6	351	< 0.4	1	< 0.5	97	< 3
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	326	<0.01	11	< 1	15	< 1	< 32	< 0.3	146	< 0.4	3	< 0.5	413	< 3
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	60	<0.01	21	< 1	6	< 1	< 32	< 0.3	21	< 0.4	< 1	246	21	< 3
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<10	<0.01	3	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	< 1	< 3
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<10	<0.01	3	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	< 1	< 3
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<10	<0.01	5	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	< 1	< 3
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	56	<0.01	38	< 1	6	< 1	< 32	< 0.3	18.3	< 0.4	< 1	70	37	< 3
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	<10	<0.01	5	< 1	< 1	< 1	< 32	< 0.3	< 0.1	< 0.4	< 1	< 0.5	< 1	< 3
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	<10	<0.01	5	< 1	< 1	< 1	< 32	< 0.3	< 0.1	< 0.4	< 1	< 0.5	< 1	< 3
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<10	<0.01	4	< 1	< 1	< 1	< 32	< 0.3	0	0.7	< 1	3	9	< 4
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<10	<0.01	3	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	3	< 3
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	<10	<0.01	6	1	1	< 1	< 32	0.6	< 0.1	4	< 1	2	24	5
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<10	<0.01	< 1	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	5	< 3
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	<10	<0.01	16	< 1	< 1	< 1	< 32	< 0.3	< 0.1	< 0.4	< 1	< 0.5	20	< 3
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<10	<0.01	3	< 1	< 1	< 1	< 32	< 0.3	<1	< 0.4	< 1	< 0.5	39	< 3
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<10	<0.01	2	< 1	< 1	< 1	< 32	< 0.3	< 0.1	< 0.4	< 1	< 0.5	2	< 3
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<10	<0.01	4	< 1	< 1	< 1	< 32	< 0.3	< 0.1	< 0.4	< 1	0.5	54	< 3

Key

MPN Most Probable Number

CFU Colony Forming Unit - Plate or Direct Counts

Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho

NG Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Silver	Sodium	Strontium	Uranium	Zinc	2,4-D	4,4 - DDT	Atrazine
							mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l
								50 µg/l	1 µg/l		20 µg/l			200 mg/l				0.1 µg/l	0.1 µg/l	0.1 µg/l
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		19.5	86	< 0.2	<0.005	5	3.4	< 1	23.1	332	3.9	31	<0.05	<10	<0.05
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		19	92	< 0.2	<5	4	3	< 1	24	323	3.3	23	<0.05	<2	<0.05
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		20	97	< 0.2	<5	4	3	< 1	24	292	3.2	17	<0.05	<2	<0.02
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		21	115	< 0.2	<5	4	3	< 1	27	330	3.2	25	<0.05	<2	<0.02
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		27.6	26	< 0.2	<0.005	< 2	0.9	< 1	10.8	236	4.1	7	<0.05	<40	<0.05
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		28	28	< 0.2	<5	2	1	< 1	12	262	4.5	15	<0.05	<2	<0.05
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		825	593	< 0.2	<0.005	< 2	303	< 1	6596	3104	0.4	6	<0.05	<2	<0.05
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		870	584	< 0.2	<5	< 2	420	< 1	6807	4064	0.9	7	<0.05	<2	<0.05
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		5	57	< 0.2	<0.005	< 2	2	< 1	10	60	<0.1	< 5	<0.05	<2	<0.05
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		10.9	35	< 0.2	<0.005	2	1.5	< 1	16.9	170	5	26	<0.05	<2	<0.05
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		8.8	< 0.4	< 0.2	<0.005	< 2	4.3	< 1	14.5	152	0.6	< 5	<0.05	<2	0.08
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		23.6	287	< 0.2	<0.005	20	2.8	< 1	35.6	363	1.3	5	<0.05	<2	<0.05
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		2.6	5	< 0.2	<0.005	< 2	1.2	< 1	197.3	13	0.7	45	<0.05	<2	0.63
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		11	37	< 0.2	<5	4	2	< 1	18	169	3.7	11	<0.05	<2	<0.05
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		10	1	< 0.2	<5	< 2	4	< 1	15	163	0.6	< 4	<0.05	<2	<0.05
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		25	312	< 0.2	<5	20	3	< 1	38	370	0.9	8	<0.05	<2	<0.05
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		25	303	< 0.2	<5	20	2	< 1	39	328	1.1	10	<0.05	<2	Not Analysed
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		12	< 0.4	< 0.2	<5	< 2	4	< 1	18	208	0.8	19	<0.05	<2	<0.15
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		12	< 0.4	< 0.2	<5	< 2	3	< 1	19	193	0.9	23	<0.05	<2	Not Analysed
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		12.8	158	< 0.2	<0.005	8	13.4	< 1	19.1	818	2.7	42	0.14	<2	<0.05
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		12	95	< 0.2	<5	2	16	< 1	18	818	3.7	14	<0.05	<2	<0.05
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		13	1019	0.2	<5	7	11	< 1	17	747	3.8	45	<0.05	<2	<0.02
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		13	8	< 0.2	<5	5	9	< 1	17	751	3.5	32	<0.05	<2	<0.02
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		34.9	113	< 0.2	<0.005	< 2	8.5	< 1	194	1372	1.5	6	<0.05	<2	<0.05
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		25	74	< 0.2	<5	< 2	10	< 1	233	865	3.6	4	<0.05	<2	<0.05
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		10	104	< 0.2	5	4	7	< 1	80	191	7.7	25	<0.05	<2	<0.02
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		15	47	< 0.2	<5	< 2	12	< 1	199.2	338	4	12	<0.05	<2	<0.02
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		9.8	320	< 0.2	<0.005	< 2	2.2	< 1	11.2	233	1.8	12	<0.05	<2	<0.05
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		23.8	20	< 0.2	<0.005	< 2	4.9	< 1	53.7	1325	2.9	7	<0.05	<2	<0.05
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		25.4	4	< 0.2	<0.005	< 2	1	< 1	8.7	143	2.8	20	<0.05	<40	<0.05
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		26	3	< 0.2	<5	< 2	<1	< 1	9	155	3	9	<0.05	<2	<0.05
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		24	2	< 0.2	<0.005	< 2	2	< 1	15	515	1.3	10	<0.05	<2	<0.05
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		24	3	0.7	<5	< 2	3	26	15	481	1.2	17	<0.05	<2	<0.05
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		23	3	< 0.2	<5	< 2	3	< 1	15	451	1.2	34	<0.05	<2	<0.02
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		22	8	< 0.2	<5	< 2	4	< 1	15	456	1	31	<0.05	<2	<0.02
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		17.3	445	< 0.2	<0.005	< 2	1	< 1	9.3	354	4.6	403	<0.05	<2	<0.05
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		15.3	< 0.4	< 0.2	<0.005	< 2	3.1	< 1	11.5	245	5.4	69	<0.05	<2	<0.05
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		5	189	< 0.2	<0.005	8	1	< 1	16	192	3.5	6	<0.05	<2	<0.10
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		1	6	< 0.2	<5	< 2	<1	< 1	6	12	<0.1	9	<0.05	<2	<0.05
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		5	197	< 0.2	<5	7	< 1	< 1	16	180	3.4	8	<0.05	<2	<0.02
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		9.1	< 0.4	< 0.2	<0.005	< 2	1.7	< 1	16.7	62	0.1	< 5	<0.05	<2	<0.05
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		9	0.5	< 0.2	<5	< 2	2	< 1	18	61	0.1	4	<0.05	<2	<0.05
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		9	< 0.4	< 0.2	<5	< 2	2	< 1	17	54	<0.1	< 4	<0.05	<2	0.03
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		9	< 0.4	< 0.2	<5	< 2	1	< 1	18	61	0.1	4	<0.05	<2	<0.02
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		12.5	7	< 0.2	<0.005	2	2.6	< 1	17.6	78	0.2	47	<0.05	<2	<0.05
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		13	39	0.3	<5	186	3	< 1	22	84	0.1	60	<0.05	<2	<0.10
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		13	3	< 0.2	<5	< 2	2	< 1	20	74	0.2	42	<0.05	<2	0.05
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		13	16	< 0.2	<5	16	2	< 1	20	78	0.1	46	<0.05	<2	<0.02
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		13.2	< 0.4	< 0.2	<0.005	< 2	1	< 1	16.7	99	0.9	< 5	<0.05	<2	<0.05
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		13	< 0.4	< 0.2	<5	< 2	1	< 1	18	96	0.8	10	<0.05	<2	<0.05
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		13	< 0.4	< 0.2	<5	< 2	< 1	< 1	17	87	0.7	8	<0.05	<2	<0.02
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		13	< 0.4	< 0.2	<5	< 2	1	< 1	17	97	0.7	31	<0.05	<2	<0.02
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		36	620	< 0.2	<5	3	7	< 1	94	310	9.6	13	<0.05	<2	<0.05
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		37	394	< 0.2	<5	< 2	7	< 1	97.0	313	9.6	7	<0.05	<2	<0.02

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Silver	Sodium	Strontium	Uranium	Zinc	2,4-D	4,4 - DDT	Atrazine
							mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l
								50 µg/l	1 µg/l		20 µg/l			200 mg/l				0.1 µg/l	0.1 µg/l	0.1 µg/l
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	25	313	< 0.2	<5	19	3	< 1	38	371	1	7	<0.05	<2	<0.05
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	25	309	< 0.2	<5	20	2	< 1	39	338	1	8	<0.05	<2	Not Analysed
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	17.3	437	< 0.2	<0.005	< 2	1	< 1	9.3	342	4.7	395	<0.05	<2	<0.05
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	16.7	148	< 0.2	<0.005	9	13.3	< 1	20.5	825	2.7	30	0.14	<2	<0.05
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	19	92	< 0.2	<5	3	3	< 1	24	322	3.3	13	<0.05	<2	<0.05
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	20	114	< 0.2	<5	4	3	< 1	25	329	3.3	24	<0.05	<2	<0.02
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	5	189	< 0.2	<0.005	8	1	< 1	16	195	3.7	6	<0.05	<2	<0.05
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	936	583	< 0.2	<5	< 2	455	< 1	6913.9	4088	0.1	6	<0.05	<2	<0.05
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	5	195	< 0.2	<5	8	< 1	< 1	16	177	3.5	7	<0.05	<2	<0.02
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	3	3	< 0.2	<5	< 2	1	< 1	6	43	<0.1	18	<0.05	<2	<0.05
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<1	< 0.4	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.05
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<1	< 0.4	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.05
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<1	0.4	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.10
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	2.8	9	< 0.2	<5	< 2	0.6	< 1	6.4	40	<0.1	35	<0.05	<2	<0.02
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	< 0.1	1	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	< 0.1	< 0.4	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	0	2	< 0.2	<0.005	< 2	0	< 1	0	< 1	<0.1	14	<0.05	<2	<0.05
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<1	0.5	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.05
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	< 0.1	0.9	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<1	< 0.4	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.05
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	< 0.1	0.6	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<1	8	< 0.2	<5	< 2	<1	< 1	<1	< 1	<0.1	< 4	<0.05	<2	<0.05
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	< 0.1	< 0.4	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	< 0.1	7	< 0.2	<5	< 2	< 0.1	< 1	< 0.2	< 1	<0.1	< 4	<0.05	<2	<0.02

Key

MPN	Most Probable Number
CFU	Colony Forming Unit - Plate or Direct Counts
Presumptive	A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG	Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Chlorotoluron	Cypermethrin	Dieldrin	Diuron	gamma - BHC	Glyphosate	Isoproturon	MCPA	Mecoprop	Simazine	m+p Xylene	MTBE	o Xylene	Toluene
							µg/l	µg/l	ng/l	µg/l	ng/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
							0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l				
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		<0.05	<0.01	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	4.6	<0.10	<0.10
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.23	4.04	0.12	0.15
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	3.28	<0.10	<0.10
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	3.06	<0.20	<0.20
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		<0.05	<0.20	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	0.26	<0.10	<0.10
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		<0.05	<0.01	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	<0.10
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		<0.05	<0.01	<3	<0.05	<2	<0.008	<0.05	<0.05	<0.04	0.16	<0.19	<0.1	<0.10	0.1
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		<0.05	<0.01	<3	<0.05	<2	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	0.12
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.10	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	Not Analysed	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	Not Analysed	<0.19	<0.10	<0.10	<0.10
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		<0.05	<0.01	<3	<0.05	<2	<0.008	<0.05	<0.05	<0.04	<0.05	0.35	<0.10	0.16	0.27
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.35	<0.10	0.15	<0.10
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		<2.00	<0.002	<6	<0.75	<2	<0.006	<2.00	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.46	<0.10	0.24	0.5
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		<1.00	<0.002	<6	<0.50	<2	Not Analysed	<2.00	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	<0.10
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		<0.05	<0.01	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	<0.10
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<0.05	<0.20	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.10	<0.19	<0.10	<0.10	<0.10
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	0.2	<0.20	<0.20	<0.20
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.20	<0.19	0.12	<0.10	<0.10
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	0.06	<0.19	<0.10	<0.10	<0.10
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		<0.05	<0.002	<6	<0.05	<2	Not analysed.	<0.20	<0.05	<0.04	<0.04	<0.20	<0.20	<0.20	<0.20
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.21	0.11	0.12	<0.10
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Chlorotoluron	Cypermethrin	Dieldrin	Diuron	gamma - BHC	Glyphosate	Isoproturon	MCPA	Mecoprop	Simazine	m+p Xylene	MTBE	o Xylene	Toluene
							µg/l	µg/l	ng/l	µg/l	ng/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
							0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l	0.1 µg/l				
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	Not Analysed	<0.19	<0.10	<0.10	<0.10
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	<0.05		<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.35	<0.10	0.17	0.3
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.10	0.22	4.56	0.12	0.1
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	3	<0.20	<0.20
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<1.00	<0.05	<0.19	<0.10	<0.10	<0.10
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	0.38	<0.10	<0.10
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	0.44
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.21	<0.10	<0.10	0.84
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	0.2
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	<0.05	<0.002	<6	<0.10	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	0.25
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	0.21
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<0.05	<0.01	<3	<0.06	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	0.48
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.29	<0.10	0.17	0.35
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.25	<0.10	0.12	0.26
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.26	<0.10	0.12	0.22
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20

Key

MPN Most Probable Number
CFU Colony Forming Unit - Plate or Direct Counts
Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Total Petroleum Hydrocarbons	Xylene	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2-Chlorophenol	2-Methylna-phthalene	2-Methylphenol	2-Nitrophenol	4,3-Chloromethyl-phenol	4-Methylphenol	4-Nitrophenol
							µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		<50.00	0.35	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		322	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		<50.00	0.52	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		<50.00	0.49	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		<100.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		<50.00	0.71	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		33	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		99	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		<50.00	<0.28	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		<50.00	0.33	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Total Petroleum Hydrocarbons µg/l	Xylene µg/l	2,4,5-Trichlorophenol µg/l	2,4,6-Trichlorophenol µg/l	2,4-Dichlorophenol µg/l	2,4-Dimethylphenol µg/l	2-Chlorophenol µg/l	2-Methylna-phthalene µg/l	2-Methylphenol µg/l	2-Nitrophenol µg/l	4,3-Chloromethyl-phenol µg/l	4-Methylphenol µg/l	4-Nitrophenol µg/l
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	55	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	379	0.52	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	<50.00	0.33	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	3	<1.0	<5.0
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	26	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	26	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	68	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	65	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	35	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<5.00
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<50.00	0.45	<1.0	<1.0	<1.0	<2.0	<1.0	<1.5	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	72	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<50.00	0.37	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<5.0
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	84	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<50.00	0.38	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0

Key

MPN Most Probable Number
CFU Colony Forming Unit - Plate or Direct Counts
Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Acenaphthene	Acenaphthylene	Anthracene	Bentazone	Benz[a] anthracene	Benzene	Benzo(alpha) pyrene	Benzo(beta) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	Chrysene	Coal Tar and Creosote related compounds	Dibenz[ah] anthracene	Ethylbenzene
							µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
												1.0 µg/l	0.01 µg/l							
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.1
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	11	<1.0	<0.10
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	0.16
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	0.14
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.00	<1.00	<0.5	<1.00	<0.10
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Acenaphthene µg/l	Acenaphthylene µg/l	Anthracene µg/l	Bentazone µg/l	Benz[a] anthracene µg/l	Benzene µg/l	Benzo(alpha) pyrene µg/l	Benzo(beta) fluoranthene µg/l	Benzo(ghi) perylene µg/l	Benzo(k) fluoranthene µg/l	Chrysene µg/l	Coal Tar and Creosote related compounds µg/l	Dibenz[ah] anthracene µg/l	Ethylbenzene µg/l
												1.0 µg/l	0.01 µg/l							
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	0.15
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	0.15	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20

Key

MPN	Most Probable Number
CFU	Colony Forming Unit - Plate or Direct Counts
Presumptive	A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG	Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Fluoranthene	Fluorene	Indeno(1,2,3 - cd) pyrene	Naphthalene	Penta-chlorophenol	Phenanthrene	Phenol	Pyrene	1,1,1,2-Tetra-chloroethane	1,1,1-Trichloro-ethane	1,1,2,2-Tetrachloro-ethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene
							µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		<1.0	<1.0	<1.0	<2.5	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.04	<0.02	<0.02	<0.02	<0.02
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	0.08	<0.02
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	0.25	<0.02	<0.02
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.05	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	0.08	<0.02
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.02	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		<1.0	<1.0	<1.0	1.7	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	60.7	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.16	<0.02	<0.02	0.03	<0.02
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.15	<0.02	<0.02	0.14	0.06
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.02	<0.02	<0.02	<0.02	<0.02
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.07	<0.02	<0.02	<0.02	<0.02
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	11.68	<0.02	0.1	0.72	1.31
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	12	<0.02	0.08	0.75	1.34
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	13.6	<0.02	<0.02	0.66	1.4
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	12.1	<0.20	<0.20	0.68	1.55
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		<1.0	<1.0	<1.0	<4.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.92	<0.02	<0.02	6.52	0.12
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	0.71	<0.20	<0.20	5.90	<0.20

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	Fluoranthene µg/l	Fluorene µg/l	Indeno(1,2,3 -cd) pyrene µg/l	Naphthalene µg/l	Penta-chlorophenol µg/l	Phenanthrene µg/l	Phenol µg/l	Pyrene µg/l	1,1,1,2-Tetra-chloroethane µg/l	1,1,1-Trichloro-ethane µg/l	1,1,2,2-Tetrachloro-ethane µg/l	1,1,2-Trichloroethane µg/l	1,1-Dichloroethane µg/l	1,1-Dichloroethene µg/l
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	<1.0	<1.0	<1.0	<2.5	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.16	<0.02	<0.02	0.03	<0.02
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.16	<0.02	<0.02	0.14	0.08
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<1.0	<1.0	<1.0	<2.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	<1.0	<1.0	<1.0	1.1	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<1.0	<1.0	<1.0	1.2	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20

Key

MPN Most Probable Number

CFU Colony Forming Unit - Plate or Direct Counts

Presumptive A presumptive positive result is defined as any positive signal obtained from a validated indirect metho

NG Value or standard not given

Urban Area	Sample Loc Code	Round No.	Sample I.D.	Sampled Date	Labware Ref.	Type	cis 1,2-Dichloroethene	Tetrachloro-ethene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride
							µg/l	µg/l	µg/l	µg/l	µg/l
								10 µg/l	3 µg/l		0.5 µg/l
Balbriggan	BAL01	R1	BAL01	09/07/2007 13:22	40106		<0.02	<0.02	<0.02	<0.02	<0.10
Balbriggan	BAL01	R2	BAL01-R2	25/10/2007 08:45	67979		<0.02	<0.02	<0.02	<0.02	<0.10
Balbriggan	BAL01	R3	BAL01-R3	29/02/2008 11:25	97278		<0.02	<0.02	<0.02	<0.02	<0.10
Balbriggan	BAL01	R4	BAL01-R4	29/05/2008 12:15	122874		<0.20	<0.20	<0.20	<0.20	<0.20
Carlow	CAR01	R1	CAR01	19/07/2007 10:45	40121		<0.02	0.03	<0.02	<0.02	<0.10
Carlow	CAR01	R2	CAR01-R2	01/10/2007 09:45	67985		<0.02	<0.02	<0.02	<0.02	<0.10
Cork	CRK01	R1	CRK01	31/07/2007 10:35	40117		<0.02	<0.02	<0.02	<0.02	<0.10
Cork	CRK01	R2	CRK01-R2	07/11/2007 10:40	67992		<0.02	<0.02	<0.02	0.03	<0.10
Cork	CRK02	R1	CRK02	31/07/2007 13:53	40118		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO01	R1	DR001	10/07/2007 10:00	40108		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO02	R1	DR002	12/07/2007 11:20	40110		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO03	R1	DR003	11/07/2007 16:15	40109		<0.02	0.3	<0.02	<0.02	<0.10
Drogheda	DRO04	R1	DR004	12/07/2007 13:40	40111		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO01	R2	DRO01-R2	31/10/2007 10:00	67983		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO02	R2	DRO02-R2	30/10/2007 10:50	67981		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO03	R2	DRO03-R2	31/10/2007 13:00	67984		<0.02	0.19	<0.02	<0.02	<0.10
Drogheda	DRO03	R3	DRO03-R3	28/02/2008 12:00	97277		<0.02	0.29	<0.02	<0.02	<0.10
Drogheda	DRO04	R2	DRO04-R2	30/10/2007 12:40	67982		<0.02	<0.02	<0.02	<0.02	<0.10
Drogheda	DRO04	R3	DRO04-R3	28/02/2008 10:05	97276		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01A	R1	DUB01A	23/07/2007 12:45	40123		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01A	R2	DUB01A-R2	23/10/2007 11:30	67972		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01A	R3	DUB01A-R3	26/02/2008 10:55	97271		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01A	R4	DUB01A-R4	27/05/2008 12:00	122870		<0.20	<0.20	<0.20	<0.20	<0.20
Dublin	DUB01B	R1	DUB01B	24/07/2007 12:25	40124		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01B	R2	DUB01B-R2	22/10/2007 15:05	67975		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01B	R3	DUB01B-R3	25/02/2008 14:30	97268		<0.02	<0.02	<0.02	<0.02	<0.10
Dublin	DUB01B	R4	DUB01B-R4	26/05/2008 12:45	122454		<0.20	<0.20	<0.20	<0.20	<0.20
Dublin	DUB02	R1	DUB02	11/07/2007 11:40	39756		<0.02	0.05	<0.02	0.09	<0.10
Dublin	DUB03	R1	DUB03	10/07/2007 13:44	40107		<0.02	<0.02	<0.02	<0.02	<0.10
Kilkenny	KIL01	R1	KIL01	19/07/2007 13:25	40122		<0.02	<0.02	<0.02	<0.02	<0.10
Kilkenny	KIL01	R2	KIL01-R2	01/11/2007 12:20	67987		<0.02	<0.02	<0.02	<0.02	<0.10
Limerick	LIM01	R1	LIM01	26/07/2007 15:25	40180		0.05	0.59	<0.02	<0.02	<0.10
Limerick	LIM01	R2	LIM01-R2	08/11/2007 13:50	67993		0.36	1.66	<0.02	0.08	<0.10
Limerick	LIM01	R3	LIM01-R3	05/03/2008 13:08	97284		0.65	2.97	<0.02	0.18	<0.10
Limerick	LIM01	R4	LIM01-R4	11/06/2008 09:55	122879		0.83	3.99	<0.20	<0.20	<0.20
Naas	NAA01	R1	NAA01	16/07/2007 10:10	40112		<0.02	<0.02	<0.02	<0.02	<0.10
Portlaoise	POR01	R1	POR01	13/07/2007 10:00	40113		<0.02	<0.02	<0.02	<0.02	<0.10
Tralee	TRA01	R1	TRA01	26/07/2007 10:15	40181		<0.02	<0.02	<0.02	<0.02	<0.10
Tralee	TRA01	R2	TRA01-R2	08/11/2007 10:20	67994		<0.02	<0.02	<0.02	<0.02	<0.10
Tralee	TRA01	R3	TRA01-R3	05/03/2008 09:25	97283		<0.02	<0.02	<0.02	<0.02	<0.10
Waterford	WAT01	R1	WAT01	17/07/2007 09:50	40116		<0.02	0.03	<0.02	<0.02	<0.10
Waterford	WAT01	R2	WAT01-R2	05/11/2007 13:05	67989		0.04	0.03	<0.02	<0.02	<0.10
Waterford	WAT01	R3	WAT01-R3	03/03/2008 12:52	97280		<0.02	0.07	<0.02	<0.02	<0.10
Waterford	WAT01	R4	WAT01-R4	09/06/2008 13:10	122876		<0.20	<0.20	<0.20	<0.20	<0.20
Waterford	WAT02	R1	WAT02	17/07/2007 11:55	40119		1.98	2.82	0.07	0.71	<0.10
Waterford	WAT02	R2	WAT02-R2	06/11/2007 09:40	67990		1.47	2.01	0.04	0.46	<0.10
Waterford	WAT02	R3	WAT02-R3	04/03/2008 09:15	97281		1.22	2.59	<0.02	0.56	<0.10
Waterford	WAT02	R4	WAT02-R4	10/06/2008 09:50	122877		1.43	2.91	<0.20	0.65	<0.20
Waterford	WAT03	R1	WAT03	17/07/2007 15:50	40120		7.58	0.04	<0.02	0.92	<0.10
Waterford	WAT03	R2	WAT03-R2	06/11/2007 11:55	67991		6.25	0.04	<0.02	0.96	<0.10
Waterford	WAT03	R3	WAT03-R3	04/03/2008 11:27	97282		7.05	0.1	<0.02	1.05	<0.10
Waterford	WAT03	R4	WAT03-R4	10/06/2008 11:35	122878		6.75	<0.20	<0.20	1	<0.20
Wexford	WEX01	R2	WEX01-R2	24/10/2007 13:50	67977		6.86	1.21	0.2	2.58	<0.10
Wexford	WEX01	R4	WEX01-R4	28/05/2008 12:25	122872		6.10	1.08	<0.20	2.36	<0.20

							cis 1,2-Dichloroethene	Tetrachloro-ethene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride
							µg/l	µg/l	µg/l	µg/l	µg/l
								10 µg/l	3 µg/l		0.5 µg/l
Urban Area	**Sample Loc Code**	**Round No.**	**Sample I.D.**	**Sampled Date**	**Labware Ref.**	**Type**					
-	-	R2	CAR02-R2	31/10/2007 11:30	67986	Duplicate	<0.02	0.18	<0.02	<0.02	<0.10
-	-	R3	CAR02-R3	28/02/2008 12:25	97275	Duplicate	<0.02	0.3	<0.02	<0.02	<0.10
-	-	R1	DUB04	16/07/2007 11:15	41704	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R1	WAT04	23/07/2007 14:35	41706	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WAT04-R2	25/10/2007 12:00	67973	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R4	WAT04-R4	29/05/2008 11:00	122875	Duplicate	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R1	WEX03	26/07/2007 13:00	41705	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WEX03-R2	07/11/2007 12:00	67995	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R3	WEX03-R3	05/03/2008 10:30	97299	Duplicate	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WB 1 - R2	02/11/2007 10:30	71441	Water Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WB 2 - R2	02/11/2007 11:00	71474	Water Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WB 3 - R2	02/11/2007 11:35	71475	Water Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	WB 4 - R2	02/11/2007 12:15	71476	Water Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R4	WB01-R4	12/06/2008 12:30	123972	Water Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	WB02-R4	12/06/2008 12:55	123973	Water Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	WB03-R4	12/06/2008 13:20	123974	Water Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R1	FB01	24/07/2007 09:15	41700	Field Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R2	FB01-R2	23/10/2007 09:15	67974	Field Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R4	FB01-R4	26/05/2008 10:05	122453	Field Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB02-R2	23/10/2007 14:00	67976	Field Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R4	FB02-R4	27/05/2008 09:55	122869	Field Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R2	FB03-R2	24/10/2007 15:10	67978	Field Blank	<0.02	<0.02	<0.02	<0.02	<0.10
-	-	R4	FB03-R4	28/05/2008 10:10	122871	Field Blank	<0.20	<0.20	<0.20	<0.20	<0.20
-	-	R4	FB04-R4	28/05/2008 13:30	122873	Field Blank	<0.20	<0.20	<0.20	<0.20	<0.20

Key

MPN	Most Probable Number
CFU	Colony Forming Unit - Plate or Direct Counts
Presumptive	A presumptive positive result is defined as any positive signal obtained from a validated indirect metho
NG	Value or standard not given

Appendix E: Ambient and Area-Weighted Concentrations

Urban Area	Code	Sample I.D.	Date	Max No. of Wells	Max No. of observations	Parameter	Colour	Conductivity	Dissolved Oxygen	Dissolved Oxygen	ORP	pH	Specific Cond.	Temp.	Turbidity	E. coli	E. coli (pres.)	Total Coliform	Total Coliform (pres.)	Ammonium	Arsenic	Chloride	Cyanide	Fluoride	Nitrate	Nitrite
						Units	Hazen	µS/cm	% Sat.	mg/l	mV	pH	µS/cm	°C	NTU	MPN/100 ml	CFU/100 ml	MPN/100 ml	CFU/100 ml	mg/l as N	µg/l	mg/l	µg/l	mg/l as F	mg/l as NO3	mg/l as N
						DWS		2500.0				6.5 - 9.5				0	0	0	0	0.3	10	250	50	1.5	50	0.5
						IGV								25.0												
						75% of DWS		1875.0				6.5 - 9.5				0	0	0	0	0.225	7.5	187.5	37.5	1.125	37.5	0.375
Dublin	UP_DUB02	DUB02	11/07/2007 11:40				20	413		1.81	138.2	7.6	494	16.38	35	<1		86		0.01	13	21	<2	0.13	0.75	<0.005
Dublin	UP_DUB03	DUB03	10/07/2007 13:44				5	764	19.3	1.72	125.4	7.78	825	21.17	1.79	<1		<1		0.05	<0.1	32	<2	0.86	<0.38	<0.005
Dublin	P0008-01	MW2	2006																							
Dublin	P0019-01	BH305				overburden																				
Dublin	P0019-01	BH307				overburden																				
Dublin	P0019-01	Avg of others	2005																		3					
Dublin	P0050-02	MW-1				No data																				
Dublin	P0078-01	overburden wells?	2005																							
Dublin	P0079-03	MW-9	2005					710				7.8		12.9						0.1		18		0.3		<0.02
Dublin	P0079-03	MW-10	2005					700				7.8		12.3						0.08		18		0.4		<0.02
Dublin	P0081-02	GW1 (D1)	2004 and 2005					1181		9.5		7.7	1181							0.1	<10	97				
Dublin	P0117-01	MW-1	2005					1170				7.7								<0.2	<10	54			11	<0.01
Dublin	P0125-01	MW-2?	2005					1004				8.25						500		<0.2	<1	16			1.7	<0.05
Dublin	P0125-02	MW-3				No data																				
Dublin	P0167-01	MW-1?	2005					809				7.9						0		0.03						
Dublin	P0231-01	BH1	2004 and 2005									6.64								5.6		70		3.3	<0.3	<0.05
Dublin	P0275-01	GW3	2006					659				7.5		12.7						<0.1	5	29		0.29	2.0	<0.003
Dublin	P0284-02	BH2	2005					572				7.92								1.1		60				
Dublin	P0392-01	MW-1?	2005/2006					779				7.72								<0.2	1	47			1.6	
Dublin	P0522-01	GW2?				Organics data only																				
Dublin	P0532-01	GW supply well	2007					703				7.8								0.47		37		0.5	0.4	<0.2
Dublin	P0552-01	GW-1	2005					1546				6.65														
Dublin	W0127-01	BH3(D)	2006					987		9		7.51		12						0.12		47	<0.5			
Dublin	W0036-02	MW-1	2006					487				7.36								0.4	2					
Dublin	W0099-01	Single well	2005				33	737				7.1								<0.2						
Dublin	W0137-01	GW-D4	2004																							
Dublin	W0164-01	BR6 (Ringsend)	2004/2005					33900		7.2		8.01								6.4	16	3103	<50	1.6	0.5	0.07
Dublin	W0196-01	n/a				no data																				
Dublin	P0250-01					Overburden wells only																				
Dublin	P0480-02	GW008	2007					449	65.8			8.89		14.92							3					
Dublin				30	19	Average	19.3	2642.8	42.6	5.8	131.8	7.7	833.3	14.6	18.4	-	-	146.6	-	0.9	4.9	260.6	<2	0.9	2.0	-
Waterford	UP_WAT01	WAT01	17/07/2007 09:50				5	279	-	1.7	192.6	6.69	360	13.26	0.45		<1		7	0.03	<1	25	<2	<0.1	6.85	<0.005
Waterford	UP_WAT01	WAT01-R2	05/11/2007 13:05				5	281	89	9.4	193.9	6.6	366	12.86	0.39		<1		<1	<0.01	<1	25	<100	<0.1	6.52	<0.005
Waterford	UP_WAT01	WAT01-R3	03/03/2008 12:52				0	306	86	9.3	163	6.3	405	12.13	0.62		5		64	0.02	<1	25	<100	<0.1	6.39	<0.005
Waterford	UP_WAT01	WAT01-R4	09/06/2008 13:10				0	288	84	8.6	142	6.7	364	14.03	0.59		0		13	<0.01	<1	24	<100	<0.1	6.7	0.013
Waterford	UP_WAT02	WAT02	17/07/2007 11:55				5	249	-	1	210	6.28	330	12.23	1.19		20		60	0.03	<1	21	<2	<0.1	4.09	<0.005
Waterford	UP_WAT02	WAT02-R2	06/11/2007 09:40				0	257	32	3.4	182	6.2	341	12.11	1.06		<1		<1	0.01	<1	24	<100	<0.1	3.71	<0.005
Waterford	UP_WAT02	WAT02-R3	04/03/2008 09:15				0	244	30	3.2	142.1	6.1	326	11.76	1.66		1		8	0.02	<1	25	<100	<0.1	3.46	<0.005
Waterford	UP_WAT02	WAT02-R4	10/06/2008 09:50				0	260	31	3.3	193	6.2	338	12.85	1.16		0		1	0.11	<1	26	<100	<0.1	3.72	<0.005
Waterford	UP_WAT03	WAT03	17/07/2007 15:50				0	357	-	0.94	209	6.77	467	12.9	0.34		<1		1	0.01	<1	25	<2	<0.1	2.67	<0.005
Waterford	UP_WAT03	WAT03-R2	06/11/2007 11:55				0	357	7	0.7	152.7	6.7	471	12.53	0.3		<1		2	0.01	<1	26	<100	<0.1	2.49	<0.005
Waterford	UP_WAT03	WAT03-R3	04/03/2008 11:27				0	342	6	0.7	150.9	6.7	448	12.54	0.65		0		0	0.03	<1	26	<100	<0.1	2.72	<0.005
Waterford	UP_WAT03	WAT03-R4	10/06/2008 11:35				0	353	12	1.3	111.5	6.7	465	12.45	0.46		0		2	0.03	<1	25	<100	<0.1	2.56	<0.005
Waterford	P0157-02	GW1	2006									7.51								<0.01	<50		69			
Waterford	P0449-02	GW1	2005									7.65								<0.2		24			27.8	<0.05
Waterford	P0525-01	GW1	2007					485				7.5								<0.2				0.2	5	
Waterford	W0018-01					Grossly polluted																				
Waterford	W0190-01					Grossly polluted																				
Waterford	P0520-01	MW3?	2007			Polluted		489				6.26		12.2							1	39			22.3	
Waterford	P0093-01	No upgrad (PPI at site and used - Q well)				Polluted		420				6.72		13.2											6.6	
Waterford	P0066-02	BH3	2007			Polluted															<0.1					
Waterford				20	17	Average	1.3	331.1	41.9	3.6	170.2	6.7	390.1	12.6	0.7	-	2.4	-	13.3	0.028	<1	25.7	<100	<0.1	7.1	<0.005
Balbriggan	UP_BAL01	BAL01	09/07/2007 13:22				7.5	567	7	0.75	128.5	7.47	756	11.88	5.97	<1		129		0.01	8	44	<2	0.11	1.15	0.02
Balbriggan	UP_BAL01	BAL01-R2	25/10/2007 08:45				5	550		1	101	7.2	743	11.42	0.39	<1		<1		0.01	6	37	<100	0.51	0.95	0.01
Balbriggan	UP_BAL01	BAL01-R3	29/02/2008 11:25				0	621	83	8.8	56.2	7.4	840	11.33	0.75	<1		<1		Not Analysed	5	40	<100	0.11	1.24	0.011
Balbriggan	UP_BAL01	BAL01-R4	29/05/2008 12:15				0	562	54	5.8	31.7	7.4	752	11.78	1.03	<1		<1		0.01	9	49	<100	0.11	1.1	0.016
Balbriggan				4	4	Average	3.1	575.0	48.0	4.1	79.4	7.4	772.8	11.6	2.0	<1	-	129.0	-	<0.01	7.0	42.5	<100	0.2	1.1	0.014
Carlow	UP_CAR01	CAR01	19/07/2007 10:45				0	513		0.33	100	7.16	683	12.03	1.79		<1		<1	0.01	1	27	<2	0.18	<0.37	<0.005
Carlow	UP_CAR01	CAR01-R2	01/10/2007 09:45				0	518	6	0.6	54.8	7.1	688	12.04	4.78		0		18	<0.01	2	25	<100	0.11	<0.37	<0.005
Carlow	P0222-01	BG unknown	2006																							
Carlow	P0287-01	AGW1?	2005									7.4										15.5	1			
Carlow				4	3	Average	0.0	515.5	6.0	0.5	77.4	7.2	685.5	12.0	3.3	-	0.0	-	9.3	0.010	1.5	22.5	1.0	0.1	<0.37	<0.005
Cork	UP_CRK01	CRK01	31/07/2007 10:35				0					7.41		15.9	0.54	<1		28		<0.30	< 1	348	<2	<0.10	<0.37	0.014
Cork	UP_CRK01	CRK01-R2	07/11/2007 10:40				0	29871	98	8.6	33.6	7.1	36688	15.27	0.8	15		179		0.27	< 1	13175	<100	<0.10	<0.37	0.007
Cork	UP_CRK02	CRK02	31/07/2007 13:53				0					7.24		17.6	1.3	<1		12		<0.30	< 1	18	2	0.41	2.5	<0.005
Cork	P0578-02	AGW2?	2005			total of 16 PAHs <0.2, t. coliforms present		519				7.37		16.2				7		0.8		26			0.6	
Cork	W012-01	BR1 and BR 7	2006			No data but text says u/g samples are good quality. SW intrusion referenced at diff location on Tramore river																				
Cork				5	4	Average	0.0	15195.0	98.0	8.6	33.6	7.3	36688.0	16.2	0.9	15.0	-	56.5	-	0.3	<1	3391.8	2.0	0.4	1.6	0.011

Table E-1: All Results for Ambient Water Quality Data by Urban Area

Urban Area	Code	Sample I.D.	Date	Max No. of Wells	Max No. of observations	Parameter	Colour	Conductivity	Dissolved Oxygen	Dissolved Oxygen	ORP	pH	Specific Cond.	Temp.	Turbidity	E. coli	E. coli (pres.)	Total Coliform	Total Coliform (pres.)	Ammonium	Arsenic	Chloride	Cyanide	Fluoride	Nitrate	Nitrite
						Units	Hazen	µS/cm	% Sat.	mg/l	mV	pH	µS/cm	°C	NTU	MPN/100 ml	CFU/100 ml	MPN/100 ml	CFU/100 ml	mg/l as N	µg/l	mg/l	µg/l	mg/l as F	mg/l as NO3	mg/l as N
						DWS		2500.0				6.5 - 9.5				0	0	0	0	0.3	10	250	50	1.5	50	0.5
						IGV								25.0												
						75% of DWS		1875.0				6.5 - 9.5				0	0	0	0	0.225	7.5	187.5	37.5	1.125	37.5	0.375
Drogheda	UP_DRO01	DR001	10/07/2007 10:00				5	437		0.89	89.7	7.22		11.84	0.65	<1		**18**		0.01	1	23	<2	0.1	0.66	0.013
Drogheda	UP_DRO01	DRO01-R2	31/10/2007 10:00				0	404	47	5.1	143.1	7.1	539	11.85	1.92	<1		**15**		0.02	< 1	22	<100	0.11	0.69	0.009
Drogheda	UP_DRO02	DR002	12/07/2007 11:20				0	426		0.91	215	7.16	579	11.14	0.94	**5**		**185**		0.01	< 1	26	<2	0.08	4.32	<0.005
Drogheda	UP_DRO02	DRO02-R2	30/10/2007 10:50				5	406	45	4.9	627	7.1	564	10.37	0.8	<1		**57**		0.02	< 1	29	<100	0.1	4.18	<0.005
Drogheda	UP_DRO03	DR003	11/07/2007 16:15				5	767		1.42	-78.6	6.98	1027	11.74	0.91	<1		<1		0.05	1	87	<2	0.17	<0.37	<0.005
Drogheda	UP_DRO03	DRO03-R2	31/10/2007 13:00				0	730	2	0.2	0.5	6.8	980	11.66	0.48	<1		<1		0.05	1	29	<100	0.19	<0.37	<0.005
Drogheda	UP_DRO03	DRO03-R3	28/02/2008 12:00				0	816	2	0.2	-5.3	6.7	1096	11.61	0.95	<1		<1		0.05	2	106	<100	0.11	<0.37	<0.005
Drogheda	UP_DRO04	DR004	12/07/2007 13:40				0	699		0.47	214	7.15	794	18.74	0.59	<1		<1		0.01	< 1	47	12	0.11	2.31	<0.005
Drogheda	UP_DRO04	DRO04-R2	30/10/2007 12:40				0	552	41	4.4	238.7	7	739	11.78	0.44	<1		<1		0.02	< 1	24	<100	<0.10	2.34	<0.005
Drogheda	UP_DRO04	DRO04-R3	28/02/2008 10:05				0	621	47	3.2	165.7	6.8	840	11.33	0.68	<1		<1		0.01	< 1	49	<100	0.12	2.69	<0.005
Drogheda	P0164-01	AGW3	2007					**17850**				7.4														
Drogheda	W033-01	BG unknown	2006			U/G well unknown. NH4 and VOCs elevated																				
Drogheda	P0376-01	BG unsure (Compre:	2007																							
Drogheda				13	11	**Average**	1.5	585.8	30.7	2.2	161.0	7.0	795.3	12.2	0.8	**5.0**	-	**68.8**	-	0.025	1.3	44.2	<100	0.12	2.46	0.004
Kilkenny	UP_KIL01	KIL01	19/07/2007 13:25				0	486		0.08	204.7	7.18	653	11.6	0.8		<1		<1	0.01	< 1	26	<2	<0.10	7.56	<0.005
Kilkenny	UP_KIL01	KIL01-R2	01/11/2007 12:20				0	497	45	4.9	172.7	7.1	660	12.09	0.23		0		0	<0.01	< 1	27	<100	<0.10	8.34	<0.005
Kilkenny	P0448-01	PW1	2006			Organohalogens ND <1		787				7.47								<0.2		28		<0.2	30.9	
Kilkenny				3	3	**Average**	0.0	590.0	45.0	2.5	188.7	7.3	656.5	11.8	0.5	-	0.0	-	0.0	0.1	<1	27.0	<100	<2	15.6	<0.005
Limerick	UP_LIM01	LIM01	26/07/2007 15:25				0	463		0.29	67.4	7.24		12.77	0.51	<1		**1**		0.03	< 1	21	<2	0.32	0.55	0.008
Limerick	UP_LIM01	LIM01-R2	08/11/2007 13:50				0	469	8	0.9	111.8	7.1	612	12.81	1.4	<1		**22**		0.01	< 1	29	<100	0.34	0.69	<0.005
Limerick	UP_LIM01	LIM01-R3	05/03/2008 13:08				0	447	7	0.7	26.3	7.1	580	12.31	0.74	<1		<1		0.01	< 1	22	<100	0.29	0.89	<0.005
Limerick	UP_LIM01	LIM01-R4	11/06/2008 09:55				0	475	14	1.5	54.7	7.2	609	13.4	1.6	<1		<1		0.02	< 1	22	<100	0.29	1.37	<0.005
Limerick	W076-01	BH103D	2005			gross pollution		1114		1.5		6.7		9.3						**0.8**		13	14	0.12		
Limerick				5	5	**Average**	0.0	593.6	9.7	1.0	65.1	7.1	600.3	12.1	1.1	<1	-	**11.5**	-	0.2	<1	21.4	14.0	0.3	0.9	<0.005
Naas	UP_NAA01	NAA01	16/07/2007 10:10			DUB04	25	478	-	0.47	-13.5	7.2	635	12.07	12.2	**1**		**8**		0.13	1	14	<2	0.3	<0.37	<0.005
Naas	P0239-01	BH1	2007									7.2									1		9			
Naas				2	2	**Average**	25.0	478.0	-	0.5	-13.5	7.2	635.0	12.1	12.2	**1.0**	-	**8.0**	-	0.1	1.0	14.0	5.0	0.3	<0.37	<0.005
Portlaoise	POR01	POR01	13/07/2007 10:00				0	585	-	0.48	193	7.01	790	11.4	0.33	<1		<1		0.01	< 1	26	<2	0.11	4.02	<0.005
Portlaoise	W184-01	MW1?	2006			organic contamination		485		3.52	-42	7.72		12.3												
Portlaoise				2	2	**Average**	0.0	535.0	-	2.0	75.5	7.4	790.0	11.9	0.3	<1	-	<1	-	0.01	<1	26.0	<2	0.1	4.0	<0.005
Tralee	UP_TRA01	TRA01	26/07/2007 10:15			WEX03	8	491	-	0.84	9.6	7.13	654	11.95	1.64	<1		<1		0.04	< 1	28	<2	<0.10	<0.37	0.006
Tralee	UP_TRA01	TRA01-R2	08/11/2007 10:20				0	52	100	10.5	721	6.9	67	13.46	0.57	<1		**2**		<0.01	< 1	14	<100	0.65	<0.37	<0.005
Tralee	UP_TRA01	TRA01-R3	05/03/2008 09:25			WEX03-R3	0	467	45	4.9	-5.8	7	626	11.7	1.57	<1		<1		0.04	1	28	<100	<0.10	<0.37	0.01
Tralee				3	3	**Average**	2.7	336.7	72.5	5.4	241.6	7.0	449.0	12.4	1.3	<1	-	**1.0**	-	0.02	0.7	23.3	<100	0.3	<0.37	0.006
Wexford	UP_WEX01	WEX01-R2	24/10/2007 13:50				>100	1004		0.4	111.2	6.9	1311	12.81	68.3	0		**3800**		0.02	7	<2	<100	<0.10	<0.37	<0.005
Wexford	UP_WEX01	WEX01-R4	28/05/2008 12:25				0	1015	14	1.7	114.3	**10.5**	1301	13.43	8.83	0		**22**		<0.01	2	231	<100	0.11	<0.37	<0.005
Wexford	P0062-02	No result for upgradient wells 3D and 4D				Polluted																				
Wexford				2	2	**Average**	25.0	1009.5	14.0	1.1	112.8	8.7	1306.0	13.1	38.6	0.0	-	**1911.0**	-	0.013	4.5	116.0	<100	0.1	<0.37	<0.005
Swords	P0083-01	Abstraction	2004					997				7.3								<0.2					2.8	
Swords	P0014-03	BH10	2006					1240		6.2		6.8		13.2						0.04		30.76		0.06	30.02	<0.02
Swords	P0060-01	MW-7D	2007					1340		7.23		7.54		12.5						<0.26	<1	203			0.4	<0.05
Swords				3	3	**Average**	-	1192.3	-	6.7	-	7.2	-	12.9	-	-	-	-	-	0.09	0.5	116.9	-	0.06	11.1	<0.05
Navan	W131-01	MW-1	2005					829.5				7.8								0.05	<1	27				0.03
Navan	W131-01	GW1 sidegradient	2005																							
Navan				1	1	**Average**	-	829.5	-	-	-	7.8	-	-	-	-	-	-	-	0.1	<1	27.0	-	-	-	0.0
Clonmel	P0027-01	MW-1	2007									7.1								0.14	<0.2	31.2			16.9	0.065
Clonmel				1	1	**Average**	-	-	-	-	-	7.1	-	-	-	-	-	-	-	0.14	<0.2	31.2	-	-	16.9	0.065
Galway	P0142-01	MW-1	2005																			50		0.3	1.2	
Galway				1	1	**Average**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	0.3	1.2	-
Newbridge	P0153-04	MW-1S	2006					1031				7.1		12						<0.2	<1	26		0.2	15.2	<0.02
Newbridge				1	1	**Average**	-	1031	-	-	-	7.1	-	12	-	-	-	-	-	<0.2	<1	26	-	0.2	15.2	<0.02
Leixlip	P0207-03	MW-10	2005					703				7.12								<0.2	<10	28		<0.5	<1	<0.05
Leixlip				1	1	**Average**	-	703	-	-	-	7.12	-	-	-	-	-	-	-	<0.2	<10	28	-	<0.5	<1	<0.05
Dundalk	W034-02	BG unknown	2005			gross NH4 pollution																				
Dundalk	P0508-02	AGW2?	2005					764				6.93								0.09		13.3		<0.1	10.86	0.01
Dundalk	P0440-01	BG unsure (Compressor House)				DRO analysed only																				
Dundalk				1	1	**Average**	-	764.0	-	-	-	6.9	-	-	-	-	-	-	-	0.1	-	13.3	-	<0.1	10.9	0.0
Clonmel	P0443-01	PW2	2004 or 2005					689		10.2		7.6								**2.1**	<1	34.2		0.3	26	
Clonmel	P0443-01	PW1	2005					691				7.2				0				<0.06	<0.5	44		0.1	13.7	
Clonmel				2	2	**Average**	-	690.0	-	10.2	-	7.4	-	-	-	0.0	-	-	-	**1.1**	<1	39.1	-	0.2	19.9	-
Ennis	W031-01	BR3	2006			gross NH4 pollution, some NH4 in u/g wells		443		4.98		7.7		15.2						**1.4**		24				
Ennis	W031-01	BR6	2006					679		3.52		7.63		12.9						**0.43**		26				
Ennis				2	2	**Average**	-	561.0	-	4.3	-	7.7	-	14.1	-	-	-	-	-	**0.9**	-	25.0	-	-	-	-
Sligo	P0643-02	MW1	2005			average conc		517				7.45								0.02		17			19.00	0.02
Sligo	W058-01	MW1	2006			high mineral oils - unspecified, former landfill and SW from estuary?						6.9						**8**		**4.8**		133				
Sligo				2	2	**Average**	-	517.0	-	-	-	7.2	-	-	-	-	-	**8.0**	-	**2.4**	-	75.0	-	-	19.0	0.0
Tullamore	W113-02	GW1	2005					496				7.6						**1**			<1	13				
Tullamore				1	1	**Average**	-	496	-	-	-	7.6	-	-	-	-	-	**1**	-	-	<1	13	-	-	-	-
Mullingar	W115-01	MW1	2005			trace organics in some wells		743				7.5								0.17		11.3		0.3		
Mullingar				1	1	**Average**	-	743	-	-	-	7.5	-	-	-	-	-	-	-	0.17	-	11.3	-	0.3	-	-

Urban Area	Code	Phosphorus (React)	Sulphate	T.O.C.	TON	Total Alkalinity	Total Dissolved Solids (180°C)	Total Hardness	Total Phosphorus	Aluminium	Antimony	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Silver	Sodium
		mg/l as P	mg/l	mg/l	mg/l as N	mgCaCO3 /l	mg/l	mgCaCO3/ l	mg P/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l
			250							200.0	5			1000	5		50		2000	200	25		50	1.0		20			200
		0.03																				50.0					5.0		
Urban Area	**Code**		187.5							150.0	3.75			750	3.75		37.5		1500	150	18.75		37.5	0.75		15			150
Dublin	UP_DUB02	**0.03**	23	1.6	0.73	200	274	233	4.03	36	<1	53	<1	<32	0.5	77.7	3	2	10	**7674**	10	9.8	**320**	<0.2	<0.005	<2	2.2	<1	11.2
Dublin	UP_DUB03	<0.01	125	<0.3	<0.38	236	464	299	<0.01	<1	<1	49	<1	39	<0.3	77.1	<0.5	<1	2	68	<4	23.8	20	<0.2	<0.005	<2	4.9	<1	53.7
Dublin	P0008-01			17.32																									
Dublin	P0019-01																												
Dublin	P0019-01																												
Dublin	P0019-01											200		**3300**	<0.4		<1		<5	3	<5		**590**			<10		<10	
Dublin	P0050-02																									5			
Dublin	P0078-01																												
Dublin	P0079-03																												
Dublin	P0079-03																												
Dublin	P0081-02		172							<10	<10	79	<10	<10	0.09		4		<0.2	**969**	<0.38		35	0.4		1			
Dublin	P0117-01		**490**							60				174	<0.4	225	**73**		11	70	<5	27		<0.5		6	4.8		28
Dublin	P0125-01		148					453	<0.01	<3		44		22	<0.4	167	2	<1		<5	<1	9	**58**	<0.05		<3	1.2		20
Dublin	P0125-02																												
Dublin	P0167-01																												
Dublin	P0231-01		<3	552												121.3			17		14	5							86
Dublin	P0275-01	<0.006	32						0.072						<0.1	83	4		3	**3619**	1	16	**261**	<0.2		4	1.2		13.08
Dublin	P0284-02																			3			**792**						
Dublin	P0392-01		100			280								114	<1	113	8		10		1	31.52		<0.05		5	3.4		34.5
Dublin	P0522-01																												
Dublin	P0532-01		100			280										63						18							91
Dublin	P0552-01																												
Dublin	W0127-01		131	4	2.2	335			<0.01					81	<0.4	152.4	1		5	<5	<1	13.65	32	<0.05		11	4.7		27
Dublin	W0036-02									6				69	<0.1		2		1	90	<1	13		<0.05		<0.1			
Dublin	W0099-01			3																									
Dublin	W0137-01													70	<0.4		<1		<5	66	<5		**141**	<0.05			**19.4**		**1380**
Dublin	W0164-01	**0.04**	**1411**									<0.5		**2495**	0.7	450	7	<1	4	7	<1		**598**	<0.05	<5	18	**180**		**1480**
Dublin	W0196-01																												
Dublin	P0250-01																												
Dublin	P0480-02																2									1			
Dublin		0.020	248.50	96.35	1.04	266.20	369.00	328.33	0.82	18.17	-	70.88	-	580.45	0.25	152.95	8.25	0.88	5.68	**1047.83**	2.90	16.68	**284.70**	<0.05	<0.005	4.58	**24.64**	<1	**293.13**
Waterford	UP_WAT01	0.01	43	<0.3	6.86	76	348	149	0.02	<1	<1	<1	<1	**1897**	<0.3	43.3	<0.5	<1	0.8	2	<4	9.1	<0.4	<0.2	<0.005	<2	1.7	<1	16.7
Waterford	UP_WAT01	<0.01	43	0.8	6.52	78	200	134	0.02	4	<1	<1	<1	44	<0.3	43	<0.4	<1	0.6	2	<3	9	0.5	<0.2	<5	<2	2	<1	18
Waterford	UP_WAT01	0.01	43	<0.8	6.39	76	240	134	0.02	3	<1	<1	<1	51	<0.3	44	0.4	<1	0.8	8	<3	9	<0.4	<0.2	<5	<2	2	<1	17
Waterford	UP_WAT01	0.02	44	<0.8	6.71	78	260	141	0.02	13	<1	<1	<1	48	0.3	44	0.9	<1	0.6	8	<3	9	<0.4	<0.2	<5	<2	1	<1	18
Waterford	UP_WAT02	0.01	45	<0.3	4.09	72	378	127	0.02	24	<1	27	<1	40	<0.3	28.3	0.6	<1	9	164	2	12.5	7	<0.2	<0.005	2	2.6	<1	17.6
Waterford	UP_WAT02	<0.01	46	1.3	3.72	68	220	144	0.02	44	<1	33	<1	<32	<0.3	29	5	3	**7959**	**969**	3	13	39	0.3	<5	**186**	3	<1	22
Waterford	UP_WAT02	<0.01	45	0.8	3.46	78	220	120	0.02	31	<1	30	<1	<32	<0.3	30	<0.4	<1	2	19	<3	13	3	<0.2	<5	<2	2	<1	20
Waterford	UP_WAT02	<0.01	44	1	3.72	74	120	128	0.02	22	<1	28	<1	<32	<0.3	28	3	<1	438	181	<3	13	16	<0.2	<5	16	2	<1	20
Waterford	UP_WAT03	0.01	22	<0.3	2.67	184	276	213	0.02	3	<1	37	<1	<32	<0.3	66.8	<0.5	<1	2	2	2	13.2	<0.4	<0.2	<0.005	<2	1	<1	16.7
Waterford	UP_WAT03	0.01	23	1.3	2.5	181	340	250	0.01	2	<1	35	<1	<32	<0.3	66	<0.4	<1	4	32	5	13	<0.4	<0.2	<5	<2	1	<1	18
Waterford	UP_WAT03	0.005	23	<0.8	2.72	184	280	210	0.02	1	<1	35	<1	<32	<0.3	66	0.7	<1	3	15	4	13	<0.4	<0.2	<5	<2	<1	<1	17
Waterford	UP_WAT03	0.005	23	<0.8	2.56	182	240	232	0.01	2	<1	35	<1	<32	<0.3	65	<0.4	<1	7	11	<3	13	<0.4	<0.2	<5	<2	1	<1	17
Waterford	P0157-02										5										21					<20			
Waterford	P0449-02	**0.05**	41		6.4											38.19											2.2		16.5
Waterford	P0525-01		45							46					**9**		<18		20				0.15			**67**			
Waterford	W0018-01																												
Waterford	W0190-01																												
Waterford	P0520-01		50			120								532	0.4	49	5		4	76						3	**6.4**		31
Waterford	P0093-01		34																	<50			44						
Waterford	P0066-02																6		<1	34	8		44			<10			
Waterford		0.012	38.4	0.6	4.5	111.6	260.2	165.2	0.0	15.0	<1	21.8	<1	209.5	<0.3	45.8	2.1	<1	4.2	103.2	4.0	11.7	10.3	<0.2	<5	7.5	2.0	<1	19.0
Balbriggan	UP_BAL01	0.02	71	0.8	1.17	277	514	392	0.02	< 1	3	46	< 1	174	< 0.3	132	< 0.5	2	2	24	< 4	19.5	**86**	< 0.2	<0.005	5	3.4	< 1	23.1
Balbriggan	UP_BAL01	0.01	19	1.4	0.96	274	460	397	0.02	2	2	44	< 1	40	< 0.3	124	< 0.4	2	1	14	< 3	19	**92**	< 0.2	<5	4	3	< 1	24
Balbriggan	UP_BAL01	0.01	75	1.5	1.25	276	460	355	0.02	4	2	45	< 1	39	< 0.3	132	< 0.4	2	1	36	< 3	20	**97**	< 0.2	<5	4	3	< 1	24
Balbriggan	UP_BAL01	0.02	73	1.3	1.12	272	480	365	0.02	6	2	47	< 1	35	< 0.3	125.1	< 0.4	2	1	65	< 3	21	**115**	< 0.2	<5	4	3	< 1	27
Balbriggan		0.0	59.5	1.3	1.1	274.8	478.5	377.3	0.0	4.0	2.3	45.5	<1	72.0	<0.3	128.3	<0.4	2.0	1.3	34.8	<3	19.9	**97.5**	<0.2	<5	4.3	3.1	<1	24.5
Carlow	UP_CAR01	<0.01	60	<0.3	<0.37	291	390	368	<0.01	4	< 1	7	< 1	< 32	< 0.3	103.3	< 0.5	< 1	< 0.5	28	< 4	27.6	26	< 0.2	<0.005	< 2	0.9	< 1	10.8
Carlow	UP_CAR01	<0.01	60	<0.8	<0.37	286	420	386	<0.01	2	< 1	8	< 1	< 32	< 0.3	105	< 0.4	< 1	< 0.5	18	< 3	28	28	< 0.2	<5	2	1	< 1	12
Carlow	P0222-01																												
Carlow	P0287-01		63									8					<10		<2							**29**		<2	
Carlow		<0.01	61.0	<0.3	<0.37	288.5	405.0	377.0	<0.01	3.0	<1	7.7	<1	<32	<0.3	104.2	<10	<1	1.0	23.0	<4	27.8	27.0	<0.2	<5	15.5	1.0	<2	11.4
Cork	UP_CRK01	<0.01	**1560**	0.4	<0.37	112	20194	4244	<0.01	3	< 1	117	< 1	**1886**	0.8	336	1	< 1	0.9	137	< 4	**825**	**593**	< 0.2	<0.005	< 2	**303**	< 1	**6596**
Cork	UP_CRK01	**0.06**	**1713**	2.1	<0.37	123	24920	4650	0.05	7	< 1	103	< 1	**3226**	0.7	326	0.9	1	< 0.5	143	< 3	**870**	**584**	< 0.2	<5	< 2	**420**	< 1	**6807**
Cork	UP_CRK02	<0.01	33	1.6	2.5	58	10	104	0.03	22	< 1	10	< 1	< 32	< 0.3	37	0.6	< 1	< 0.5	71	< 4	5	**57**	< 0.2	<0.005	< 2	2	< 1	10
Cork	P0578-02																												
Cork	W012-01																												
Cork		**0.060**	**1102.0**	1.4	2.5	97.7	15041.3	2999.3	0.0	10.7	<1	76.7	<1	**2556.0**	0.8	233.0	0.8	1.0	0.9	117.0	<4	**566.7**	**411.3**	<0.2	<5	<2	**241.7**	<1	**4471.0**

Urban Area	Code	Phosphorus (React)	Sulphate	T.O.C.	TON	Total Alkalinity	Total Dissolved Solids (180°C)	Total Hardness	Total Phosphorus	Aluminium	Antimony	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Silver	Sodium
		mg/l as P	mg/l	mg/l	mg/l as N	mgCaCO3 /l	mg/l	mgCaCO3/ l	mg P/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l
			250							200.0	5			1000	5		50		2000	200	25		50	1.0		20			200
		0.03																				50.0					5.0		
Urban Area	**Code**		187.5							150.0	3.75			750	3.75		37.5		1500	150	18.75		37.5	0.75		15			150
Drogheda	UP_DRO01	**0.07**	16	<0.3	0.67	243	322	281	0.07	4	< 1	6	< 1	< 32	1	85	< 0.5	2	< 0.5	44	< 4	10.9	35	< 0.2	<0.005	2	1.5	< 1	16.9
Drogheda	UP_DRO01	**0.06**	60	<0.8	0.7	244	620	279	0.07	3	< 1	5	< 1	43	1	88	< 0.4	2	< 0.5	13	< 3	11	37	< 0.2	<5	4	2	< 1	18
Drogheda	UP_DRO02	**0.04**	17	1.5	4.33	224	312	261	0.05	3	< 1	46	< 1	< 32	< 0.3	91	0.9	< 1	3	4	< 4	8.8	< 0.4	< 0.2	<0.005	< 2	4.3	< 1	14.5
Drogheda	UP_DRO02	**0.03**	44	1	4.18	248	380	287	0.03	8	< 1	30	< 1	< 32	< 0.3	102	0.6	< 1	6	8	< 3	10	1	< 0.2	<5	< 2	4	< 1	15
Drogheda	UP_DRO03	<0.01	57	2	<0.37	322	614	430	<0.01	7	< 1	201	< 1	< 32	< 0.3	152	< 0.5	2	0.9	**297**	< 4	23.6	**287**	< 0.2	<0.005	**20**	2.8	< 1	35.6
Drogheda	UP_DRO03	0.02	59	1.3	<0.37	338	600	452	0.01	4	< 1	213	< 1	< 32	< 0.3	151	< 0.4	2	0.5	**331**	< 3	25	**312**	< 0.2	<5	**20**	3	< 1	38
Drogheda	UP_DRO03	<0.01	62	1.3	<0.37	334	640	443	0.01	3	< 1	200	< 1	< 32	< 0.3	161	< 0.4	2	0.8	**359**	< 3	25	**303**	< 0.2	<5	**20**	2	< 1	39
Drogheda	UP_DRO04	<0.01	40	0.5	2.32	290	556	38	0.01	5	< 1	3	< 1	< 32	< 0.3	7.6	1	< 1	103	10	< 4	2.6	5	< 0.2	<0.005	< 2	1.2	< 1	197.3
Drogheda	UP_DRO04	0.01	17	0.8	2.34	280	460	257	0.01	3	< 1	39	< 1	< 32	< 0.3	139	1	< 1	10	4	< 3	12	< 0.4	< 0.2	<5	< 2	4	< 1	18
Drogheda	UP_DRO04	<0.01	42	1.4	2.69	282	460	365	0.01	2	< 1	40	< 1	36	< 0.3	144	1	< 1	15	22	< 3	12	< 0.4	< 0.2	<5	< 2	3	< 1	19
Drogheda	P0164-01		226			263		1693								354	30		250			**408**				**30**			
Drogheda	W033-01																												
Drogheda	P0376-01																												
Drogheda		**0.038**	58.2	1.2	2.5	278.9	496.4	435.1	0.0	4.2	<1	78.3	<1	20.7	0.3	134.1	3.2	1.3	35.4	109.2	<4	49.9	**140.0**	<0.2	<5	**16.0**	2.8	<1	41.1
Kilkenny	UP_KIL01	<0.01	16	<0.3	7.57	278	388	350	<0.01	6	< 1	1	< 1	< 32	< 0.3	97.4	0.9	< 1	< 0.5	6	< 4	25.4	4	< 0.2	<0.005	< 2	1	< 1	8.7
Kilkenny	UP_KIL01	**0.03**	16	<0.8	8.35	280	360	345	<0.01	1	< 1	< 1	< 1	< 32	< 0.3	99	0.9	< 1	< 0.5	3	< 3	26	3	< 0.2	<5	< 2	<1	< 1	9
Kilkenny	P0448-01				7																								
Kilkenny		**0.030**	16.0	<0.8	7.6	279.0	374.0	347.5	<0.01	3.5	<1	1.0	<1	<32	<0.3	98.2	0.9	<1	<0.5	4.5	<4	25.7	3.5	<0.2	<5	<2	1.0	<1	8.9
Limerick	UP_LIM01	<0.01	26	<0.3	0.56	278	414	310	<0.01	< 1	< 1	67	< 1	35	< 0.3	86	< 0.5	< 1	3	32	< 4	24	2	< 0.2	<0.005	< 2	2	< 1	15
Limerick	UP_LIM01	<0.01	30	<0.8	0.7	288	440	380	<0.01	7	< 1	64	< 1	69	< 0.3	88	< 0.4	< 1	4	41	< 3	24	3	0.7	<5	< 2	3	26	15
Limerick	UP_LIM01	0.01	29	<0.8	0.89	274	320	310	<0.01	7	< 1	68	< 1	41	< 0.3	90	< 0.4	< 1	16	57	< 3	23	3	< 0.2	<5	< 2	3	< 1	15
Limerick	UP_LIM01	<0.01	33	<0.8	1.38	274	340	321	<0.01	8	< 1	66	< 1	51	< 0.3	92	< 0.4	< 1	15	54	< 3	22	8	< 0.2	<5	< 2	4	< 1	15
Limerick	W076-01	<0.006	59	23	<0.3		0.1		0.068					19	<0.09	229.1	25									4			
Limerick		0.0	35.4	23.0	0.7	278.5	302.8	330.3	0.0	7.3	<1	66.3	<1	43.0	<0.9	117.0	5.2	<1	9.5	46.0	<4	23.3	4.0	<0.2	<5	1.6	3.0	<1	15.0
Naas	UP_NAA01	0.01	24	<0.3	<0.37	300	382	327	<0.01	44	< 1	287	< 1	< 32	< 0.3	105.4	0.5	< 1	1	**659**	< 4	17.3	**445**	< 0.2	<0.005	< 2	1	< 1	9.3
Naas	P0239-01		49											111	<0.09		1		7		2			0.2		2			
Naas		0.0	36.5	<0.3	<0.37	300.0	382.0	327.0	<0.01	44.0	<1	287.0	<1	63.5	<0.3	105.4	0.8	<1	4.0	**659.0**	2.0	17.3	**445.0**	0.2	<0.005	1.5	1.0	<1	9.3
Portlaoise	POR01	0.01	38	1.4	4.03	332	474	405	<0.01	< 1	< 1	97	< 1	40	< 0.3	147.5	< 0.5	< 1	3	2	< 4	15.3	< 0.4	< 0.2	<0.005	< 2	3.1	< 1	11.5
Portlaoise	W184-01																												
Portlaoise		0.0	38.0	1.4	4.0	332.0	474.0	405.0	<0.01	<1	<1	97.0	<1	40.0	<0.3	147.5	<0.5	<1	3.0	2.0	<4	15.3	<0.4	<0.2	<0.005	<2	3.1	<1	11.5
Tralee	UP_TRA01	<0.01	10	0.4	<0.37	312	412	330	0.01	4	< 1	14	< 1	< 32	< 0.3	148	< 0.5	3	< 0.5	**466**	< 4	5	**189**	< 0.2	<0.005	8	1	< 1	16
Tralee	UP_TRA01	<0.01	2	3.3	<0.37	<10	140	44	<0.01	31	< 1	1	< 1	< 32	< 0.3	5	< 0.4	< 1	6	23	< 3	1	6	< 0.2	<5	< 2	<1	< 1	6
Tralee	UP_TRA01	**0.03**	11	1	<0.37	312	360	330	<0.01	13	< 1	16	< 1	< 32	< 0.3	146	< 0.4	3	< 0.5	**415**	< 3	5	**197**	< 0.2	<5	7	< 1	< 1	16
Tralee		0.013	7.7	1.6	<0.37	312.0	304.0	234.7	0.0	16.0	<1	10.3	<1	<32	<0.03	99.7	<0.5	3.0	2.2	**301.3**	<4	3.7	**130.7**	<0.2	<5	5.3	0.7	<1	12.7
Wexford	UP_WEX01	0.01	<2	1	<0.37	251	820	465	0.06	31	< 1	175	< 1	52	< 0.3	140	2	4	99	**5997**	< 3	36	**620**	< 0.2	<5	3	**7**	< 1	94
Wexford	UP_WEX01	0.01	71	1.2	<0.37	250	760	470	0.02	33	< 1	157	< 1	51	< 0.3	138.3	3	1	61	**1188**	< 3	37	**394**	< 0.2	<5	< 2	**7**	< 1	97
Wexford	P0062-02																												
Wexford		0.0	36.5	1.1	<0.37	250.5	790.0	467.5	0.0	32.0	<1	166.0	<1	51.5	<0.3	139.2	2.5	2.5	80.0	**3592.5**	<3	36.5	**507.0**	<0.2	<0.5	2.0	**7.0**	<1	95.5
Swords	P0083-01	<0.03		4	0.6											95.01								<0.05					
Swords	P0014-03				6.78																								
Swords	P0060-01	**0.06**	110			360		522	<0.01	<0.002		88		63	**7**	143	10	1	3	20	5	40	**600**	0.025		8	**5.6**		70
Swords		**0.04**	110.0	4.0	3.7	360.0	-	522.0	<0.01	0.0	-	88.0	-	63.0	**7.0**	119.0	10.0	1.0	3.0	20.0	5.0	40.0	**600.0**	<0.05	-	8.0	**5.6**	-	70.0
Navan	W131-01		54		0.28				25	3		231	<2	23	<2	114	18	<1	35	167		37	7	<1	<1	11	2		18
Navan	W131-01																												
Navan		-	54.0	-	0.3	-	-	-	25.0	3.0	-	231.0	<2	23.0	<2	114.0	18.0	<1	35.0	167.0	-	37.0	7.0	<1	<1	11.0	2.0	-	18.0
Clonmel	P0027-01	**3.84**	11.4							**307.5**		9.2			<0.1	164.4	3	<1	10.4	148.2	1.3	10.8	**68.1**	0.07		6.6			
Clonmel		**3.84**	11.4	-	-	-	-	-	-	**307.5**	-	9.2	-	-	<0.1	164.4	3.0	<1	10.4	148.2	1.3	10.8	**68.1**	0.1	-	6.6	-	-	-
Galway	P0142-01		142																										40.3
Galway		-	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.3
Newbridge	P0153-04	<0.03	37			310				112				113	<1	162	12		<1	34	<1	21.5	0.8			6	1.1		21.5
Newbridge		<0.03	37	-	-	310	-	-	-	112	-	-	-	113	<1	162	12	-	<1	34	<1	21.5	0.8	-	-	6	1.1	-	21.5
Leixlip	P0207-03	**0.05**	81			296		372							<5	111	<10	<10	<10	**670**	<5	23	20			<10	1.5		12
Leixlip		**0.05**	81	-	-	296	-	372	-	-	-	-	-	-	<5	111	<10	<10	<10	**670**	<5	23	20	-	-	<10	1.5	-	12
Dundalk	W034-02																												
Dundalk	P0508-02	0.005	91.6													102.2						16.9					1.4		16.4
Dundalk	P0440-01																												
Dundalk		0.0	91.6	-	-	-	-	-	-	-	-	-	-	-	-	102.2	-	-	-	-	-	16.9	-	-	-	-	1.4	-	16.4
Clonmel	P0443-01		25	1.4	4.6	320						50		15	<0.4		5		30	<5	<1	15		<0.05		1	0.7		12
Clonmel	P0443-01		18	0.8		313	415	337						30	<0.24	113.5	0.66		10	60	<1	13.1	30	<0.14		<1.4	0.71		35
Clonmel		-	21.5	1.1	4.6	316.5	415.0	337.0	-	-	-	50.0	-	22.5	<0.4	113.5	2.8	-	20.0	31.3	<1	14.1	30.0	<0.05	-	0.9	0.7	-	23.5
Ennis	W031-01			13	2.97																						1.4		19
Ennis	W031-01			13																							**5.6**		21
Ennis		-	-	13.0	2.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.5	-	20.0
Sligo	P0643-02	**0.18**	79						2.2	0.24	<10				<10		<10	<10	<10	140	<10		16.5	<1		<10			
Sligo	W058-01																												
Sligo		**0.18**	79.0	-	-	-	-	-	2.2	0.2	<10	-	-	-	5.0	-	<10	<10	<10	140.0	<10	-	16.5	<1	-	<10	-	-	-
Tullamore	W113-02				<0.2					**210**							<50		<0.2	**340**	<0.38	13.2	**2190**	0.7		<0.1	2.06		11.7
Tullamore		-	-	-	<0.2	-	-	-	-	**210**	-	-	-	-	-	-	<50	-	<0.2	**340**	<0.38	13.2	**2190**	0.7	-	<0.1	2.06	-	11.7
Mullingar	W115-01		21.2		0.41	385										150						20					<1		8
Mullingar		-	21.2	-	0.41	385	-	-	-	-	-	-	-	-	-	150	-	-	-		-	20	-	-	-	-	<1	-	8

Table E-1: All Results for Ambient Water Quality Data by Urban Area

		Strontium	Uranium	Zinc	2,4-D	4,4 - DDT	Atrazine	Chlorot-oluron	Cyperm-ethrin	Dieldrin	Diuron	gamma - BHC	Glyphosate	Isoproturon	MCPA	Mecoprop	Simazine	m+p Xylene	MTBE	o Xylene	Toluene	Total Petroleum Hydrocarbons	Xylene	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2-Chlorophenol	2-Methylnaphthalene	2-Methylphenol
		µg/l	µg/l	µg/l	µg/l	ng/l	µg/l	µg/l	µg/l	ng/l	µg/l	ng/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1													
Urban Area	**Code**				0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075													
Dublin	UP_DUB02	233	1.8	12	<0.05	<2	<0.05	<0.05	<0.1	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.2	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Dublin	UP_DUB03	1325	2.9	7	<0.05	<2	<0.05	<0.05	<0.1	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.2	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Dublin	P0008-01																													
Dublin	P0019-01																													
Dublin	P0019-01																													
Dublin	P0019-01			<5																										
Dublin	P0050-02																													
Dublin	P0078-01																													
Dublin	P0079-03																	<10			<10		<10							
Dublin	P0079-03																	<10			<10		<10							
Dublin	P0081-02			98														1.3		8.6										
Dublin	P0117-01			40						<0.01								<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0125-01	527		<3														<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0125-02																													
Dublin	P0167-01																													
Dublin	P0231-01			116														<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0275-01			23														<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0284-02			42																										
Dublin	P0392-01			61														<10			<10		<10							
Dublin	P0522-01																													
Dublin	P0532-01																													
Dublin	P0552-01																													
Dublin	W0127-01			15								<0.1						<1	4	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0036-02			79														<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0099-01																	<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0137-01			55								<0.1						<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0164-01			79														<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0196-01																													
Dublin	P0250-01																													
Dublin	P0480-02			32														<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dublin		695.00	2.35	44.20	<0.05	<2	<0.05	<0.05	<0.1	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<1	<1	<1	<1	<10	<10	<1	<1	<1	<1	<1	<1	<1
Waterford	UP_WAT01	62	0.1	<5	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.02	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT01	61	0.1	4	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.02	<0.1	<0.1	<0.1	<50	<0.3	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT01	54	<0.1	<4	<0.05	<2	0.03	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.2	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT01	61	0.1	4	<0.05	<2	<0.02		<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	0.2	<0.2	<0.2	<0.2	<50	<0.4	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT02	78	0.2	47	<0.05	<2	<0.05		<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.02	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT02	84	0.1	60	<0.05	<2	<0.1		<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.02	<0.02	0.12	<0.1	<0.1	<50	<0.3	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT02	74	0.2	42	<0.05	<2	0.05		<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	0.06	<0.2	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT02	78	0.1	46	<0.05	<2	<0.02		<0.002	<6	<0.05	<2	Not analysed	<0.2	<0.05	<0.04	<0.04	<0.02	<0.2	<0.2	<0.2	<50	<0.4	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT03	99	0.9	<5	<0.05	<2	<0.05		<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.02	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT03	96	0.8	10	<0.05	<2	<0.05		<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.02	<0.1	<0.1	<0.1	<50	<0.3	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT03	87	0.7	8	<0.05	<2	<0.02		<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.02	<0.1	<0.2	<0.3	<50	<0.28	<1	<1	<1	<2	<1	<1	<1
Waterford	UP_WAT03	97	0.7	31	<0.05	<2	<0.02		<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.02	<0.2	<0.2	<0.2	<50	<0.4	<1	<1	<1	<2	<1	<1	<1
Waterford	P0157-02																					<50								
Waterford	P0449-02																													
Waterford	P0525-01			503														<1		<1	<1		<1							
Waterford	W0018-01																													
Waterford	W0190-01																													
Waterford	P0520-01			35																										
Waterford	P0093-01																	<10	<20	<20	<20		<20							
Waterford	P0066-02			25																										
Waterford		77.6	0.3	22.8	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.02	<0.02	<0.1	<0.1	<0.1	<50	<3	<1	<1	<1	<2	<1	<1	<1
Balbriggan	UP_BAL01	332	3.9	31	<0.05	<10	<0.05	<0.05	<0.01	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	4.6	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Balbriggan	UP_BAL01	323	3.3	23	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.23	4.04	0.12	0.15	<50.00	0.35	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Balbriggan	UP_BAL01	292	3.2	17	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	3.28	<0.10	<0.10	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Balbriggan	UP_BAL01	330	3.2	25	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	3.06	<0.20	<0.20	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Balbriggan		319.3	3.4	24.0	<0.05	<2	<0.05	<0.05	#DIV/0!	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	0.1	3.7	0.1	0.1	<50	0.2	<1	<1	<1	<1	<1	<1	<1
Carlow	UP_CAR01	236	4.1	7	<0.05	<40	<0.05	<0.05	<0.20	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	322	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Carlow	UP_CAR01	262	4.5	15	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Carlow	P0222-01																													
Carlow	P0287-01																	<1	<1	<1	<1		<1							
Carlow		249.0	4.3	11.0	<0.05	<40	<0.05	<0.05	<0.2	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.1	<0.1	173.5	<0.28	<1	<1	<1	<2	<1	<1	<1
Cork	UP_CRK01	3104	0.4	6	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Cork	UP_CRK01	4064	0.9	7	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.10	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	0.26	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Cork	UP_CRK02	60	<0.1	< 5	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Cork	P0578-02																													
Cork	W012-01																													
Cork		2409.3	0.7	6.5	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	0.1	<0.10	<0.1	<50	<0.29	<1	<1	<1	<2	<1	<1	<1

		Strontium	Uranium	Zinc	2,4-D	4,4 - DDT	Atrazine	Chlorot-oluron	Cyperm-ethrin	Dieldrin	Diuron	gamma - BHC	Glyphosate	Isoproturon	MCPA	Mecoprop	Simazine	m+p Xylene	MTBE	o Xylene	Toluene	Total Petroleum Hydrocarbons	Xylene	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2-Chlorophenol	2-Methylnaphthalene	2-Methylphenol
		µg/l	µg/l	µg/l	µg/l	ng/l	µg/l	µg/l	µg/l	ng/l	µg/l	ng/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1													
Urban Area	**Code**				0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075													
Drogheda	UP_DRO01	170	5	26	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<5	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Drogheda	UP_DRO01	169	3.7	11	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	UP_DRO02	152	0.6	< 5	<0.05	<2	**0.08**	<0.05	<0.01	<3	<0.05	<2	<0.008	<0.05	<0.05	<0.04	**0.16**	<0.19	<0.1	<0.10	0.1	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Drogheda	UP_DRO02	163	0.6	< 4	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.10	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	UP_DRO03	363	1.3	5	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<2	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Drogheda	UP_DRO03	370	0.9	8	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	UP_DRO03	328	1.1	10	<0.05	<2	Not Analyse	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	Not Analyse	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	UP_DRO04	13	0.7	45	<0.05	<2	**0.63**	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.10	0.12	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Drogheda	UP_DRO04	208	0.8	19	<0.05	<2	<0.15	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	UP_DRO04	193	0.9	23	<0.05	<2	Not Analyse	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	Not Analyse	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Drogheda	P0164-01																													
Drogheda	W033-01																													
Drogheda	P0376-01																													
Drogheda		212.9	1.6	18.4	<0.05	<2	**0.1**	<0.05	<0.01	<6	<0.05	<2	<0.008	<0.05	<0.05	<0.04	0.05	<0.19	<0.10	<0.10	0.1	<50	<0.29	<1	<1	<1	<2	<1	<1	<1
Kilkenny	UP_KIL01	143	2.8	20	<0.05	<40	<0.05	<0.05	<0.20	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Kilkenny	UP_KIL01	155	3	9	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Kilkenny	P0448-01																													
Kilkenny		149.0	2.9	14.5	<0.05	<40	<0.05	<0.05	<0.20	<60	<0.05	<20	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.1	<0.1	<50	<0.29	<1	<1	<1	<2	<1	<1	<1
Limerick	UP_LIM01	515	1.3	10	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Limerick	UP_LIM01	481	1.2	17	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Limerick	UP_LIM01	451	1.2	34	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10	99	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Limerick	UP_LIM01	456	1	31	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Limerick	W076-01			<1.8																										
Limerick		475.8	1.2	18.6	<0.05	<2	<0.05	<0.05	<0.01	<6	<0.05	<2	<0.008	<0.05	<0.05	<0.04	<0.05	<0.2	<0.2	<0.2	<0.2	<50	<0.4	<1	<1	<1	<2	<1	<1	<1
Naas	UP_NAA01	354	4.6	403	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Naas	P0239-01			14														<1		<1	<1		<1							
Naas		354.0	4.6	208.5	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<1	<0.1	<1	<1	<50	<1	<1	<1	<1	<2	<1	<1	<1
Portlaoise	POR01	245	5.4	69	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Portlaoise	W184-01																													
Portlaoise		245.0	5.4	69.0	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.1	<0.1	<0.1	<50	<0.28	<1	<1	<1	<1	<1	<1	<1
Tralee	UP_TRA01	192	3.5	6	<0.05	<2	<0.10	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.10	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
Tralee	UP_TRA01	12	<0.1	9	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	<0.19	<0.10	<0.10	<0.10	<50.00	<0.29	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Tralee	UP_TRA01	180	3.4	8	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Tralee		128.0	2.3	7.7	<0.05	<2	<0.1	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.19	<0.10	<0.10	<0.10	<50.00	<0.28	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Wexford	UP_WEX01	310	9.6	13	<0.05	<2	<0.05	<0.05	<0.01	<3	<0.05	<1	<0.008	<0.05	<0.05	<0.04	<0.05	0.21	0.11	0.12	<0.10	<50.00	0.33	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Wexford	UP_WEX01	313	9.6	7	<0.05	<2	<0.02	<0.05	<0.002	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	<0.20	<0.20	<0.20	<0.20	<50.00	<0.40	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Wexford	P0062-02																													
Wexford		311.5	9.6	10.0	<0.05	<2	<0.02	<0.05	<0.01	<6	<0.05	<2	<0.006	<0.05	<0.05	<0.04	<0.02	0.2	0.1	0.1	<0.20	<50.00	0.3	<1	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0
Swords	P0083-01																	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Swords	P0014-03									nd		nd						<1	<1	<1										
Swords	P0060-01	1.34		81														<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Swords		1.3	-	81.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<1
Navan	W131-01		<1	334														<10			<10	<0.1	<10							
Navan	W131-01																													
Navan		-	<1	334.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	<10	<0.1	<10	-	-	-	-	-	-	-
Clonmel	P0027-01			15.4		<1				<1		<1						<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Clonmel		-	-	15.4	-	<1	-	-	-	<1	-	<1	-	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Galway	P0142-01																													
Galway		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Newbridge	P0153-04			37														<1		<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Newbridge		-	-	37	-	-	-	-	-	-	-	-	-	-	-	-	-	<1		<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Leixlip	P0207-03			20														<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Leixlip		-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Dundalk	W034-02																													
Dundalk	P0508-02																	<1	<1	<1	<1		<1							
Dundalk	P0440-01																													
Dundalk		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	-	<1	-	-	-	-	-	-	-
Clonmel	P0443-01			10																										
Clonmel	P0443-01																													
Clonmel		-	-	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ennis	W031-01																	<1	<1	<1	<1		<1							
Ennis	W031-01																	<1	<1	<1	<1		<1							
Ennis		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	-	<1	-	-	-	-	-	-	-
Sligo	P0643-02			15														<1	<1	<1	<1		<1							
Sligo	W058-01																													
Sligo		-	-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	-	<1	-	-	-	-	-	-	-
Tullamore	W113-02			<10																										
Tullamore		-	-	<10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mullingar	W115-01																													
Mullingar		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		2-Nitrophenol	4,3-Chloromethylphenol	4-Methylphenol	4-Nitrophenol	Acenaphthene	Acenaphthylene	Anthracene	Bentazone	Benz[a]anthracene	Benzene	Benzo (alpha) pyrene	Benzo (beta) fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Coal Tar and Creosote related compounds	Dibenz [ah] anthracene	Ethylbenzene	Fluoranthene	Fluorene	Indeno(1,2,3 - cd)pyrene	Naphthalene	Pentachlorophenol	Phenanthrene	Phenol	Pyrene	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
											1.0	0.01																	
Urban Area	**Code**										0.75	0.0075																	
Dublin	UP_DUB02	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	<0.02
Dublin	UP_DUB03	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	<0.02
Dublin	P0008-01																												
Dublin	P0019-01																												
Dublin	P0019-01																												
Dublin	P0019-01																												
Dublin	P0050-02																												
Dublin	P0078-01																												
Dublin	P0079-03										<10								<10									<10	<10
Dublin	P0079-03										<10								<10									<10	<10
Dublin	P0081-02																		0.57										
Dublin	P0117-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0125-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0125-02																												
Dublin	P0167-01																												
Dublin	P0231-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0275-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	P0284-02																												
Dublin	P0392-01					<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Dublin	P0522-01																												
Dublin	P0532-01																												
Dublin	P0552-01																												
Dublin	W0127-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0036-02	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0099-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0137-01	<1	<1	<1	<1	0.092	0.012	<0.01		<0.01	<1	<0.01	<0.01	<0.01	<0.01	<0.01	<1	<0.01	<1	0.01	0.048	<0.01	0.249	<1	0.051	<1	0.013	<1	<1
Dublin	W0164-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin	W0196-01																												
Dublin	P0250-01																												
Dublin	P0480-02	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Waterford	UP_WAT01	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	0.03
Waterford	UP_WAT01	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	0.02
Waterford	UP_WAT01	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	0.07
Waterford	UP_WAT01	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.2	<1	<1	<1	<1	<1	<1	<1	<0.2	<1	<1	<1	<1	<1	<1	<2	<1	<0.2	<0.2
Waterford	UP_WAT02	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	<0.02
Waterford	UP_WAT02	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	<0.02
Waterford	UP_WAT02	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	<0.02
Waterford	UP_WAT02	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.2	<1	<1	<1	<1	<1	<1	<1	<0.2	<1	<1	<1	<1	<1	<1	<2	<1	<0.2	<0.2
Waterford	UP_WAT03	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	11.68
Waterford	UP_WAT03	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	12
Waterford	UP_WAT03	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<1	<1	<2	<1	<0.02	13.6
Waterford	UP_WAT03	<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.2	<1	<1	<1	<1	<1	<1	<1	<0.2	<1	<1	<1	<1	<1	<1	<2	<1	<0.2	12.1
Waterford	P0157-02																			<1	<1	<1	<1				<1		
Waterford	P0449-02																												
Waterford	P0525-01										<1								<1				<1				<1	<1	26
Waterford	W0018-01																												
Waterford	W0190-01																												
Waterford	P0520-01																												
Waterford	P0093-01										<20								<20				<20					<20	<20
Waterford	P0066-02																												<1
Waterford		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.12	<1	<1	<1	<1	<1	<1	<1	<0.02	<1	<1	<1	<1	<5	<1	<2	<1	<0.2	5.7
Balbriggan	UP_BAL01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Balbriggan	UP_BAL01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<2.5	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Balbriggan	UP_BAL01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Balbriggan	UP_BAL01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20
Balbriggan		<1	<1	<1	<1	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	<0.5	<1	<2	<1	<1	<1	<2.5	<5	<1	<2	<1	<0.2	<0.2
Carlow	UP_CAR01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Carlow	UP_CAR01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.04
Carlow	P0222-01																												
Carlow	P0287-01					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carlow		<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<2	0.2
Cork	UP_CRK01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Cork	UP_CRK01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Cork	UP_CRK02	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Cork	P0578-02																												
Cork	W012-01																												
Cork		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	<0.02

		2-Nitrophenol	4,3-Chloromethylphenol	4-Methylphenol	4-Nitrophenol	Acenaphthene	Acenaphthylene	Anthracene	Bentazone	Benz[a]anthracene	Benzene	Benzo (alpha) pyrene	Benzo (beta) fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Coal Tar and Creosote related compounds	Dibenz [ah] anthracene	Ethylbenzene	Fluoranthene	Fluorene	Indeno(1,2,3 - cd)pyrene	Naphthalene	Pentachlorophenol	Phenanthrene	Phenol	Pyrene	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
											1.0	0.01																	
Urban Area	**Code**										0.75	0.0075																	
Drogheda	UP_DRO01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Drogheda	UP_DRO01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Drogheda	UP_DRO02	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.1	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Drogheda	UP_DRO02	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	11	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.02
Drogheda	UP_DRO03	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Drogheda	UP_DRO03	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Drogheda	UP_DRO03	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Drogheda	UP_DRO04	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.1	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.05
Drogheda	UP_DRO04	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.03
Drogheda	UP_DRO04	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Drogheda	P0164-01																												
Drogheda	W033-01																												
Drogheda	P0376-01																												
Drogheda		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	1.3	<1	<0.1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	0.0
Kilkenny	UP_KIL01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Kilkenny	UP_KIL01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Kilkenny	P0448-01																												
Kilkenny		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.11	<1	<1	<1	<1	<1	<0.5	<1	<0.1	<1	<1	<1	<1	<5	<1	<2	<1	<0.02	<0.02
Limerick	UP_LIM01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.00	<1.00	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Limerick	UP_LIM01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	60.7	<1.0	<0.02	<0.02
Limerick	UP_LIM01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Limerick	UP_LIM01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	<0.20
Limerick	W076-01																												
Limerick		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<0.2	<1	<1	<1	<1	<1	<0.5	<1	<0.2	<1	<1	<1	<1	<5	<1	<2	<1	<0.2	<0.2
Naas	UP_NAA01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Naas	P0239-01										<1								<1				<1					<1	<1
Naas		<1	<1	<1	<5	<1	<1	<1	<0.05	<1	<1	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<5	<1	<2	<1	<1	<1
Portlaoise	POR01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Portlaoise	W184-01																												
Portlaoise		<1	<1	<1	<5	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	<0.02
Tralee	UP_TRA01	<1.00	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<0.05	<1.0	<0.11	<1.0	<1	<1.00	<1.0	<1.00	<0.5	<1.00	<0.10	<1.00	<1.00	<1.0	<1.00	<5.00	<1.00	<2.00	<1.00	<0.02	0.16
Tralee	UP_TRA01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	<0.02
Tralee	UP_TRA01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.15
Tralee		<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.107
Wexford	UP_WEX01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.11	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.10	<1.0	<1.0	<1.0	<4.0	<5.0	<1.0	<2.0	<1.0	<0.02	0.92
Wexford	UP_WEX01	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	0.71
Wexford	P0062-02																												
Wexford		<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<0.05	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<0.20	<1.0	<1.0	<1.0	<1.0	<5.0	<1.0	<2.0	<1.0	<0.20	0.8
Swords	P0083-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Swords	P0014-03										<0.8								<1.5									<1	<1
Swords	P0060-01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Swords		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<1	<1.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Navan	W131-01										<10								<10	<10			<0.5	<0.1	<0.1	<0.1	<0.1	<10	<10
Navan	W131-01																												
Navan		-	-	-	-	-	-	-	-	-	<10	-	-	-	-	-	-	-	<10	<10	-	-	<0.5	<0.1	<0.1	<0.1	<0.1	<10	<10
Clonmel	P0027-01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Clonmel		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Galway	P0142-01																												
Galway		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Newbridge	P0153-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Newbridge		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Leixlip	P0207-03	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Leixlip		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dundalk	W034-02																												
Dundalk	P0508-02					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dundalk	P0440-01																												
Dundalk		-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Clonmel	P0443-01																												
Clonmel	P0443-01																												
Clonmel		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ennis	W031-01					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ennis	W031-01					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ennis		-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sligo	P0643-02					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sligo	W058-01																												
Sligo		-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tullamore	W113-02																												
Tullamore		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mullingar	W115-01																												
Mullingar		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	cis 1,2-Dichloroethene	Tetrachloroethene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride	Total PAH	TCE + PCE
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
										0.5	0.01	10
Urban Area	**Code**											
Dublin	UP_DUB02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	0.09	<0.1		
Dublin	UP_DUB03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1		
Dublin	P0008-01											
Dublin	P0019-01											
Dublin	P0019-01											
Dublin	P0019-01											
Dublin	P0050-02											
Dublin	P0078-01											
Dublin	P0079-03	<10	<10	<10	<10	<10	<10	<10	<10	<10		
Dublin	P0079-03	<10	<10	<10	<10	<10	<10	<10	<10	<10		
Dublin	P0081-02											
Dublin	P0117-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	P0125-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	P0125-02											
Dublin	P0167-01											
Dublin	P0231-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	P0275-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	P0284-02											
Dublin	P0392-01											
Dublin	P0522-01											
Dublin	P0532-01											
Dublin	P0552-01											
Dublin	W0127-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	W0036-02	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	W0099-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	W0137-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	W0164-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin	W0196-01											
Dublin	P0250-01											
Dublin	P0480-02	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dublin		<1	<1	<1	<1	<1	<1	<1	<1	<1		
Waterford	UP_WAT01	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02		
Waterford	UP_WAT01	<0.02	<0.02	<0.02	<0.02	0.04	0.03	<0.02	<0.02	<0.02		
Waterford	UP_WAT01	<0.02	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02	<0.02		
Waterford	UP_WAT01	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Waterford	UP_WAT02	<0.02	<0.02	<0.02	<0.02	1.98	2.82	0.07	0.71	<0.02		
Waterford	UP_WAT02	<0.02	<0.02	<0.02	<0.02	1.47	2.01	0.04	0.46	<0.02		
Waterford	UP_WAT02	<0.02	<0.02	<0.02	<0.02	1.22	2.59	<0.02	0.56	<0.02		
Waterford	UP_WAT02	<0.2	<0.2	<0.2	<0.2	1.43	2.91	<0.2	0.65	<0.2		
Waterford	UP_WAT03	<0.02	0.1	0.72	1.31	7.58	0.04	<0.02	0.92	<0.02		
Waterford	UP_WAT03	<0.02	0.08	0.75	1.34	6.25	0.04	<0.02	0.96	<0.02		
Waterford	UP_WAT03	<0.02	<0.02	0.66	1.4	7.05	0.1	<0.02	1.05	<0.02		
Waterford	UP_WAT03	<0.2	<0.2	0.68	1.55	6.75	<0.2	<0.2	1	<0.2		
Waterford	P0157-02											
Waterford	P0449-02											
Waterford	P0525-01	<1	<1	<1	<1	2	<1	<1	3	<1		
Waterford	W0018-01											
Waterford	W0190-01											
Waterford	P0520-01											
Waterford	P0093-01	<20	<20	<20	<20	3340	<20	<20	403	22		
Waterford	P0066-02											
Waterford		<0.2	<0.2	1.0	1.2	241.1	1.5	<0.02	29.5	<0.02		
Balbriggan	UP_BAL01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Balbriggan	UP_BAL01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Balbriggan	UP_BAL01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Balbriggan	UP_BAL01	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20		
Balbriggan		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Carlow	UP_CAR01	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.10		
Carlow	UP_CAR01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Carlow	P0222-01											
Carlow	P0287-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Carlow		<1	<1	<1	<1	<1	0.2	<1	<1	<1	-	-
Cork	UP_CRK01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Cork	UP_CRK01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.10		
Cork	UP_CRK02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Cork	P0578-02											
Cork	W012-01											
Cork		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.1	-	-

Urban Area	Code	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	cis 1,2-Dichloroethene	Tetrachloroethene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride	Total PAH	TCE + PCE
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
										0.5	0.01	10
Drogheda	UP_DRO01	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO01	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO03	<0.02	0.25	<0.02	<0.02	<0.02	0.3	<0.02	<0.02	<0.10		
Drogheda	UP_DRO03	<0.02	<0.02	<0.02	<0.02	<0.02	0.19	<0.02	<0.02	<0.10		
Drogheda	UP_DRO03	<0.02	<0.02	<0.02	<0.02	<0.02	0.29	<0.02	<0.02	<0.10		
Drogheda	UP_DRO04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	UP_DRO04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Drogheda	P0164-01											
Drogheda	W033-01											
Drogheda	P0376-01											
Drogheda		<0.02	<0.02	<0.02	<0.02	<0.02	0.09	<0.02	<0.02	<0.1	-	-
Kilkenny	UP_KIL01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Kilkenny	UP_KIL01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Kilkenny	P0448-01											
Kilkenny		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	-	-
Limerick	UP_LIM01	<0.02	<0.02	<0.02	<0.02	0.05	0.59	<0.02	<0.02	<0.10		
Limerick	UP_LIM01	<0.02	<0.02	<0.02	<0.02	0.36	1.66	<0.02	0.08	<0.10		
Limerick	UP_LIM01	<0.02	<0.02	<0.02	<0.02	0.65	2.97	<0.02	0.18	<0.10		
Limerick	UP_LIM01	<0.20	<0.20	<0.20	<0.20	0.83	3.99	<0.20	<0.20	<0.20		
Limerick	W076-01											4
Limerick		<0.2	<0.2	<0.2	<0.2	0.5	2.3	<0.2	0.1	<0.2	-	4.0
Naas	UP_NAA01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Naas	P0239-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Naas		<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-
Portlaoise	POR01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Portlaoise	W184-01											
Portlaoise		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Tralee	UP_TRA01	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Tralee	UP_TRA01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10		
Tralee	UP_TRA01	<0.02	<0.02	0.14	0.06	<0.02	<0.02	<0.02	<0.02	<0.10		
Tralee		<0.02	<0.02	0.06	0.03	<0.02	<0.02	<0.02	<0.02	<0.10		
Wexford	UP_WEX01	<0.02	<0.02	6.52	0.12	6.86	1.21	0.2	2.58	<0.10		
Wexford	UP_WEX01	<0.20	<0.20	5.9	<0.20	6.1	1.08	<0.20	2.36	<0.20		
Wexford	P0062-02											
Wexford		<0.2	<0.20	6.2	0.1	6.5	1.1	0.2	2.5	<0.2		
Swords	P0083-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Swords	P0014-03	<1	<0.8	<1	<1	<1.1	<1.1	<1.1	<1.1	<1		
Swords	P0060-01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
Swords		<1	<1	<1	<1	<1	<1	<1	<1	<1		
Navan	W131-01	<10	<10	<10	<10	<10	<10	<10	<10	<10		
Navan	W131-01											
Navan		<10	<10	<10	<10	<10	<10	<10	<10	<10		
Clonmel	P0027-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Clonmel		<1	<1	<1	<1	<1	<1	<1	<1	<1		
Galway	P0142-01											
Galway		-	-	-	-	-	-	-	-	-	-	-
Newbridge	P0153-04	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Newbridge		<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-
Leixlip	P0207-03	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Leixlip		<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-
Dundalk	W034-02											
Dundalk	P0508-02	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Dundalk	P0440-01											
Dundalk		<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-
Clonmel	P0443-01											
Clonmel	P0443-01											
Clonmel		-	-	-	-	-	-	-	-	-		
Ennis	W031-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Ennis	W031-01	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Ennis		<1	<1	<1	<1	<1	<1	<1	<1	<1		
Sligo	P0643-02	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Sligo	W058-01											
Sligo		<1	<1	<1	<1	<1	<1	<1	<1	<1		
Tullamore	W113-02											
Tullamore		-	-	-	-	-	-	-	-	-	-	-
Mullingar	W115-01											
Mullingar		-	-	-	-	-	-	-	-	-	-	-

Parameter	Colour	Conductivity	Dissolved Oxygen	Dissolved Oxygen	pH	Temp	E. Coli	E.Coli (presumptive)	Total Coliform	Total Coliform (presumptive)	Ammonium	Arsenic
Units	Hazen	µS/cm	% Sat.	mg/l	pH	°C	MPN/100 ml	CFU/100ml	MPN/100 ml	CFU/100ml	mg/l as N	µg/l
DWS		2500			6.5 - 9.5		0	0	0	0	0.3	10
IGV						25.0						
75% of DWS		1875			6.5 - 9.5		0	0	0	0	0.225	7.5
Urban Area												
Dublin	19.3	**2643**	42.6	5.8	7.7	14.6	<1	<1	**147**	-	**0.9**	4.9
Dublin (excluding saline wells		804										
Waterford	1.3	331	41.9	3.6	6.7	12.6	-	**2.4**	-	**13.3**	0.03	<1
Balbriggan	3.1	575	48.0	4.1	7.4	11.6	<1	-	**129**	-	<0.01	7.0
Carlow	0.0	516	6.0	0.5	7.2	12.0	-	0.0	-	**9.3**	0.01	1.5
Cork	0.0	**15195**	98.0	8.6	7.3	16.2	**15.0**	-	**57**	-	**0.3**	<1
Drogheda	1.5	586	30.7	2.2	7.0	12.2	**5.0**	-	**69**	-	0.03	1.3
Kilkenny	0.0	590	45.0	2.5	7.3	11.8	-	0.0	-	0.0	0.1	<1
Limerick	0.0	594	9.7	1.0	7.1	12.1	<1	-	**12**	-	0.2	<1
Naas	25.0	478	-	0.5	7.2	12.1	**1.0**	-	**8**	-	0.1	1.0
Portlaoise	0.0	535	-	2.0	7.4	11.9	<1	-	<1	-	0.01	<1
Tralee	2.7	337	72.5	5.4	7.0	12.4	<1	-	**1**	-	0.02	0.7
Wexford	25.0	1010	14.0	1.1	8.7	13.1	0.0	-	**1911**	-	0.01	4.5
Swords	-	1192	-	6.7	7.2	12.9	-	-	-	-	0.09	0.5
Navan	-	830	-	-	7.8	-	-	-	-	-	0.1	<1
Clonmel	-	-	-	-	7.1	-	-	-	-	-	0.14	<0.2
Galway	-	-	-	-	-	-	-	-	-	-	-	-
Newbridge	-	1031	-	-	7.1	12	-	-	-	-	<0.2	<1
Leixlip	-	703	-	-	7.12	-	-	-	-	-	<0.2	<10
Dundalk	-	764	-	-	6.9	-	-	-	-	-	0.1	-
Clonmel	-	690	-	10.2	7.4	-	0.0	-	-	-	**1.1**	<1
Ennis	-	561	-	4.3	7.7	14.1	-	-	-	-	**0.9**	-
Sligo	-	517	-	-	7.2	-	-	-	**8**	-	**2.4**	-
Tullamore	-	496	-	-	7.6	-	-	-	**1**	-	-	<1
Mullingar	-	743	-	-	7.5	-	-	-	-	-	0.17	-

Parameter	Chloride	Cyanide	Fluoride	Nitrate	Nitrite	Phosphorus (React)	Sulphate	Total Alkalinity	Total Hardness	Aluminium	Antimony	Barium	Beryllium	Boron
Units	mg/l	µg/l	mg/l as F	mg/l as NO3	mg/l as N	mg/l as P	mg/l	mgCaCO3 /l	mgCaCO3 /l	µg/l	µg/l	µg/l	µg/l	µg/l
DWS	250	50	1.5	50	0.5		250			200	5			1000
IGV						0.03								
75% of DWS	187.5	37.5	1.125	37.5	0.375		187.5			150	3.75			750
Urban Area														
Dublin	**261**	<2	0.9	2.0	-	0.02	249	266	328	18	-	71	-	580
Dublin (excluding saline wells	45						147							
Waterford	26	<100	<0.1	7.1	<0.005	0.01	38	112	165	15	<1	22	<1	210
Balbriggan	43	<100	0.2	1.1	0.014	0.02	60	275	377	4	2.3	46	<1	72
Carlow	23	1.0	0.1	<0.37	<0.005	<0.01	61	289	377	3	<1	8	<1	<32
Cork	**3392**	2.0	0.4	1.6	0.011	**0.06**	**1102**	98	2999	11	<1	77	<1	**2556**
Drogheda	44	<100	0.12	2.46	0.004	**0.04**	58	279	435	4	<1	78	<1	21
Kilkenny	27	<100	<2	15.6	<0.005	**0.03**	16	279	348	4	<1	1	<1	<32
Limerick	21	14.0	0.3	0.9	<0.005	0.01	35	279	330	7	<1	66	<1	43
Naas	14	5.0	0.3	<0.37	<0.005	0.01	37	300	327	44	<1	287	<1	64
Portlaoise	26	<2	0.1	4.0	<0.005	0.01	38	332	405	<1	<1	97	<1	40
Tralee	23	<100	0.3	<0.37	0.006	0.01	8	312	235	16	<1	10	<1	<32
Wexford	116	<100	0.1	<0.37	<0.005	0.01	37	251	468	32	<1	166	<1	52
Swords	117	-	0.06	11.1	<0.05	**0.04**	110	360	522	0	-	88	-	63
Navan	27	-	-	-	0.0	-	54	-	-	3	-	231	<2	23
Clonmel	31	-	-	16.9	0.065	**3.84**	11	-	-	**308**	-	9	-	-
Galway	50	-	0.3	1.2	-	-	142	-	-	-	-	-	-	-
Newbridge	26	-	0.2	15.2	<0.02	<0.03	37	310	-	112	-	-	-	113
Leixlip	28	-	<0.5	<1	<0.05	**0.05**	81	296	372	-	-	-	-	-
Dundalk	13	-	<0.1	10.9	0.0	0.01	92	-	-	-	-	-	-	-
Clonmel	39	-	0.2	19.9	-	-	22	317	337	-	-	50	-	23
Ennis	25	-	-	-	-	-	-	-	-	-	-	-	-	-
Sligo	75	-	-	19.0	0.0	**0.18**	79	-	-	0	<10	-	-	-
Tullamore	13	-	-	-	-	-	-	-	-	**210**	-	-	-	-
Mullingar	11	-	0.3	-	-	-	21	385	-	-	-	-	-	-

NOTE:

1 - averages calculated from available data - data are indicative rather than representative.

2 - averages calculated from a range of data populations - some urban areas are represented by data from a single well only.

Parameter	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Silver	Sodium	Strontium	Uranium	Zinc	2,4-D	4,4 - DDT	Atrazine	Chloro-toluron	Cypermethrin	Diuron	gamma - BHC	Glyphosate
Units	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l	µg/l	µg/l	µg/l	ng/l	µg/l
DWS	5		50		2000	200	25		50	1.0		20			200				0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
IGV								50.0					5.0													
75% of DWS	3.75		37.5		1500	150	18.75		37.5	0.75		15			150				0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075
Urban Area																										
Dublin	0.25	153	8.25	0.88	5.68	**1048**	2.90	16.68	**285**	<0.05	<0.005	4.58	**24.6**	<1	**293**	695.0	2.35	44.2	<0.05	<2	<0.05	<0.05	<0.1	<0.05	<1	<0.008
Dublin (excluding saline wells															**174**											
Waterford	<0.3	46	2.1	<1	4.2	103	4.0	11.7	10	<0.2	<5	7.5	2.0	<1	19	77.6	0.3	22.8	<0.05	<2	<0.05	<0.05	<0.01	<0.05	<1	<0.008
Balbriggan	<0.3	128	<0.4	2.0	1.3	35	<3	19.9	**98**	<0.2	<5	4.3	3.1	<1	25	319.3	3.4	24.0	<0.05	<2	<0.05	<0.05	#DIV/0!	<0.05	<5	<0.008
Carlow	<0.3	104	<10	<1	1.0	23	<4	27.8	27	<0.2	<5	15.5	1.0	<2	11	249.0	4.3	11.0	<0.05	<40	<0.05	<0.05	<0.2	<0.05	<20	<0.008
Cork	0.8	233	0.8	1.0	0.9	117	<4	**566.7**	**411**	<0.2	<5	<2	**241.7**	<1	**4471**	2409.3	0.7	6.5	<0.05	<2	<0.05	<0.05	<0.01	<0.05	<1	<0.008
Drogheda	0.3	134	3.2	1.3	35.4	109	<4	49.9	**140**	<0.2	<5	**16.0**	2.8	<1	41	212.9	1.6	18.4	<0.05	<2	**0.1**	<0.05	<0.01	<0.05	<2	<0.008
Kilkenny	<0.3	98	0.9	<1	<0.5	5	<4	25.7	4	<0.2	<5	<2	1.0	<1	9	149.0	2.9	14.5	<0.05	<40	<0.05	<0.05	<0.20	<0.05	<20	<0.008
Limerick	<0.9	117	5.2	<1	9.5	46	<4	23.3	4	<0.2	<5	1.6	3.0	<1	15	475.8	1.2	18.6	<0.05	<2	<0.05	<0.05	<0.01	<0.05	<2	<0.008
Naas	<0.3	105	0.8	<1	4.0	**659**	2.0	17.3	**445**	0.2	<0.005	1.5	1.0	<1	9	354.0	4.6	208.5	<0.05	<2	<0.05	<0.05	<0.01	<0.05	<1	<0.008
Portlaoise	<0.3	148	<0.5	<1	3.0	2	<4	15.3	<0.4	<0.2	<0.005	<2	3.1	<1	12	245.0	5.4	69.0	<0.05	<2	<0.05	<0.05	<0.01	<0.05	<1	<0.008
Tralee	<0.03	100	<0.5	3.0	2.2	**301**	<4	3.7	**131**	<0.2	<5	5.3	0.7	<1	13	128.0	2.3	7.7	<0.05	<2	<0.1	<0.05	<0.002	<0.05	<2	<0.006
Wexford	<0.3	139	2.5	2.5	80.0	**3593**	<3	36.5	**507**	<0.2	<0.5	2.0	**7.0**	<1	96	311.5	9.6	10.0	<0.05	<2	<0.02	<0.05	<0.01	<0.05	<2	<0.006
Swords	**7.0**	119	10.0	1.0	3.0	20	5.0	40.0	**600**	<0.05	-	8.0	**5.6**	-	70	1.3	-	81.0	-	-	-	-	-	-	-	-
Navan	<2	114	18.0	<1	35.0	167	-	37.0	7	<1	<1	11.0	2.0	-	18	-	<1	334.0	-	-	-	-	-	-	-	-
Clonmel	<0.1	164	3.0	<1	10.4	148	1.3	10.8	**68**	0.1	-	6.6	-	-	-	-	-	15.4	-	<1	-	-	-	-	<1	-
Galway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-
Newbridge	<1	162	12	-	<1	34	<1	21.5	1	-	-	6	1.1	-	22	-	-	37.0	-	-	-	-	-	-	-	-
Leixlip	<5	111	<10	<10	<10	**670**	<5	23	20	-	-	<10	1.5	-	12	-	-	20.0	-	-	-	-	-	-	-	-
Dundalk	-	102	-	-	-	-	-	16.9	-	-	-	-	1.4	-	16	-	-	-	-	-	-	-	-	-	-	-
Clonmel	<0.4	114	2.8	-	20.0	31	<1	14.1	30	<0.05	-	0.9	0.7	-	24	-	-	10.0	-	-	-	-	-	-	-	-
Ennis	-	-	-	-	-	-	-	-	-	-	-	-	3.5	-	20	-	-	-	-	-	-	-	-	-	-	-
Sligo	5.0	-	<10	<10	<10	140	<10	-	17	<1	-	<10	-	-	-	-	-	15.0	-	-	-	-	-	-	-	-
Tullamore	-	-	<50	-	<0.2	**340**	<0.38	13.2	**2190**	0.7	-	<0.1	2.06	-	12	-	-	<10	-	-	-	-	-	-	-	-
Mullingar	-	150	-	-	-		-	20	-	-	-	-	<1	-	8	-	-	-	-	-	-	-	-	-	-	-
NOTE:																										

Parameter	Isoproturon	MCPA	Mecoprop	Simazine	MTBE	Toluene	Total Petroleum Hydro-carbons	Xylene	Acenaphthene	Bentazone	Benzene	Coal Tar and Creosote related compounds	Ethylbenzene	Indeno(1,2,3 - cd)pyrene	Naphthalene	Phenol	1,1,1-TCA	1,1-DCA	1,1-DCE	cis 1,2-DCE	PCE	trans-1,2-DCE	TCE	Vinyl Chloride
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
DWS	0.1	0.1	0.1	0.1							1.0													0.5
IGV 75% of DWS	0.075	0.075	0.075	0.075							0.75													
Urban Area																								
Dublin	<0.05	<0.05	<0.04	<0.05	<1	<1	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dublin (excluding saline wells																								
Waterford	<0.05	<0.05	<0.04	<0.02	<0.1	<0.1	<50	<3	<1	<0.05	<0.12	<1	<0.02	<1	<1	<2	5.7	1.0	1.2	241.1	1.5	<0.02	29.5	<0.02
Balbriggan	<0.05	<0.05	<0.04	<0.05	3.7	0.1	<50	0.2	<1	<0.05	<0.11	<0.5	<2	<1	<2.5	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carlow	<0.05	<0.05	<0.04	<0.05	<0.10	<0.1	173.5	<0.28	<1	<1	<1	<0.5	<1	<1	<1	<2	0.2	<1	<1	<1	0.2	<1	<1	<1
Cork	<0.05	<0.05	<0.04	<0.05	0.1	<0.1	<50	<0.29	<1	<0.05	<0.11	<0.5	<1	<1	<1	<2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.1
Drogheda	<0.05	<0.05	<0.04	0.05	<0.10	0.1	<50	<0.29	<1	<0.05	<0.11	1.3	<0.1	<1	<1	<2	0.0	<0.02	<0.02	<0.02	0.09	<0.02	<0.02	<0.1
Kilkenny	<0.05	<0.05	<0.04	<0.05	<0.1	<0.1	<50	<0.29	<1	<0.05	<0.11	<0.5	<0.1	<1	<1	<2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1
Limerick	<0.05	<0.05	<0.04	<0.05	<0.2	<0.2	<50	<0.4	<1	<0.05	<0.2	<0.5	<0.2	<1	<1	<2	<0.2	<0.2	<0.2	0.5	2.3	<0.2	0.1	<0.2
Naas	<0.05	<0.05	<0.04	<0.05	<0.1	<1	<50	<1	<1	<0.05	<1	<0.5	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Portlaoise	<0.05	<0.05	<0.04	<0.05	<0.1	<0.1	<50	<0.28	<1.00	<0.05	<0.11	<0.5	<0.10	<1.0	<1.00	<2.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.10
Tralee	<0.05	<0.05	<0.04	<0.02	<0.10	<0.10	<50.00	<0.28	<1.0	<0.05	<0.11	<0.5	<0.10	<1.0	<1.0	<2.0	0.107	0.06	0.03	<0.02	<0.02	<0.02	<0.02	<0.10
Wexford	<0.05	<0.05	<0.04	<0.02	0.1	<0.20	<50.00	0.3	<1.0	<0.05	<0.20	<0.5	<0.20	<1.0	<1.0	<2.0	0.8	6.2	0.1	6.5	1.1	0.2	2.5	<0.2
Swords	-	-	-	-	<1	<1	<0.1	<1	<1	<1	<1	<0.1	<1.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Navan	-	-	-	-	-	<10	<0.1	<10	-	-	<10	-	<10	-	<0.5	<0.1	<10	<10	<10	<10	<10	<10	<10	<10
Clonmel	-	-	-	-	-	<1	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Galway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Newbridge	-	-	-	-		<1	-	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Leixlip	-	-	-	-	<1	<1	-	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dundalk	-	-	-	-	<1	<1	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Clonmel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ennis	-	-	-	-	<1	<1	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sligo	-	-	-	-	<1	<1	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tullamore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mullingar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NOTE:																								

Location	Facility Type	Year	Unit	No. of Wells Onsite	Conductivity	pH	Escherichia coli	Total Coliform	Ammonium	Arsenic	Chloride	Cyanide	Fluoride	Nitrate	Nitrite	Phosphorus (React)	Sulphate	Aluminium	Antimony	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese
					µS/cm		0 counts per 100ml	0 counts per 100ml	mg/l as N	µg/l	mg/l	µg/l	mg/l	mg/l	mg/l as N	mg/l as P	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
			75% DWS IGV		1875	6.5 - 9.5	0	0	0.225	7.5	187.5	37.5	1.125	37.5	0.375	0.03	187.5	150	3.75	750	3.75	37.5	1500	150	7.50	37.5
Waterford	Urban Footprint Area	41.65km^2																								
No. of impacted sites		7																								
P0066-02	CL	2004		4	nd	6.7	nd	nd	nd	4.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	4	2	11.75	5	nd	**11.0**	**5251**
P0093-01	CL	2007		4	424	6.68	nd	nd	nd	nd	nd	nd	nd	8.8	nd	nd	23	nd	nd	nd	nd	nd	nd	nd	nd	35
P0157-02	IPPC	2006		3	nd	7.37	nd	nd	<0.1	nd	nd	nd	0.05	nd	nd	nd	nd	nd	<10	nd	nd	nd	nd	nd	**10.3**	nd
P0385-01	CL	2008		10	463	6.83	nd	nd	**2**	<1	66	nd	nd	17.0	0.095	nd	28	nd	nd	54	0.46	<1	1	nd	<0.5	**3515**
P0449-02	IPPC	2007/2008		1	289	6.57	**2**	**21**	**13**	<1	**1392**	<100	<0.05	15.1	0.046	**2.149**	103	5.1	<1	510	0.19	0.4	1	5	<3	0.28
P0520-01	CL	2007 (excl MW5)		3	532	6.98	nd	nd	**1**	6.5	28	<0.05	nd	11.9	0.047	nd	44	nd	nd	624	<1	6.3	2	94	<1	nd
P0525-01	IPPC/CL	2007 and 2008		2	547	7.34	nd	nd	<0.2	3	24	<0.05	0.20	3.4	<1	nd	44	25.5	nd	<50	**9.00**	1.0	20	9	6.0	**430**
W0018-01	Landfill	2006		9	**3318**	7.08	**0.1**	**565**	**143**	**8**	**391**	nd	0.26	nd	<0.001	**0.107**	31	**239.9**	<1	**4188**	<0.1	8.0	3	**4524**	**8.2**	**1335**
W0190-01	CL	2006		5	**2196**	7.99	nd	nd	**26**	nd	**383**	0.722	nd	nd	nd	nd	nd	nd	nd	nd	<0.4	1.1	<2	**152**	2.1	**885**
		Average of Ambient GW Quality			331	6.7	2	13	0.028	<1	26	<2	<0.1	7.1	<0.005	0.012	38	15	<1	210	0.3	2.1	4	103	4	10
		Area weighted average			365	6.7	**2**	**16**	**1.1**	0.61	33	0.95	0.05	7.29	0.003	0.02	39	15.94	<1	232	0.35	2.21	4	129	4.16	**58**
Dublin	Urban Footprint Area	288.34km^2																								
No. of impacted sites		10																								
P0008-01	IPPC	No data			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0050-02	IPPC	No data			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0078-01	IPPC/CL	2006		2	**4315**	8.05	nd	nd	**44**	**28**	112	nd	<0.1	<0.2	0.025	**0.67**	159	36	<2	557	<2	9.0	12	**1425**	<2	**2627**
P0079-03	IPPC	2005		10	686	7.88	nd	nd	0.13	nd	15	nd	0.42		0.013	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0081-02	IPPC	2004 - 2006		1	1181	7.70	nd	nd	0.11	<10	169	nd	nd	nd	nd	nd	172	<10	<10	<10	0.09	4.0	<0.2	**969**	<0.38	35
P0109-01	CL	No data			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0111-01	CL	No data			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0117-01	IPPC	2005		3	1007	7.62	nd	nd	0.1	2.2	37	nd	nd	7.2	0.050	nd	**242**	3	nd	81	<1	16.3	2	17	<1	nd
P0125-01	IPPC	2005		3	1852	7.90	nd	**186**	**0.8**	1.8	**241**	nd	nd	0.8	<0.05	nd	167	<3	nd	150	<0.4	2.0	<1	**935**	<1	**1331**
P0164-01	CL	2008		4	**3270**	**6.40**	nd	nd	**158.4**	6.5	nd	nd	nd	nd	nd	nd	nd	nd	2.50	nd	<0.4	7.8	5	nd	**27.25**	nd
P0167-01	IPPC	2005		2	807	7.75	nd	nd	0.03	nd	nd	nd	nd	<0.4	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0217-01	CL	No data			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0231-01	IPPC	2003/2005		1	nd	6.89	nd	nd	0.10	nd	85	nd	**0.9**	52	0.070	nd	79	nd	nd	nd	nd	nd	0	nd	3.80	nd
P0250-01	CL	2006		7-11	893	7.49	nd	nd	**0.26**	nd	22	nd	nd	36.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0275-01	IPPC	2006		4	475	7.60	nd	nd	<0.09	**8.6**	17	nd	0.33	1.3	<0.004	0.005	24	nd	nd	nd	0.78	14.0	38	**11849**	**16.75**	**933**
P0284-02	IPPC	2005		2	683	7.90	nd	nd	**0.60**	nd	62	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	4	nd	**400**
P0326-01	CL	2008		8	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0392-01	IPPC	2006		3	1009	7.65	nd	nd	<0.2	0.8	38	nd	nd	30.4	nd	nd	186	nd	nd	111	<0.1	9.3	7	nd	1.50	nd
P0468-01	CL	No data, but no contamination			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0480-01	IPPC	2007 and 2008		6-12	735	8.39	nd	nd	nd	1.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.37	5.8	17	nd	<0.4	nd
P0486-01	CL	No data, but no contamination			nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0522-01	IPPC	2006		3	nd	7.26	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0532-01	IPPC/CL	2007		5-9	565	8.36	nd	nd	0.20	nd	30	nd	0.45	0.8	<0.2	nd	61	nd	nd	nd	nd	nd	nd	nd	nd	nd
P0552-01	IPPC	2005		10	1029	7.64	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
W0099-01	Waste	2006		1	737	7	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
W0127-01	Waste	2006		6	1029	7.53	nd	nd	**0.25**	nd	30	<50	nd	nd	nd	**0.21**	60	nd	nd	124	<0.4	2.8	2	22	<1	24
W0137-01	Waste	2004		2	**9011**	7.16	nd	nd	**1.00**	nd	**3161**	<50	0.55	nd	nd	**0.11**	**340**	nd	nd	nd	nd	nd	nd	nd	nd	nd
W0164-01	Waste	2004 and 2005		2	**34250**	8.03	nd	nd	nd	**20**	nd	nd	nd	nd	nd	nd	nd	nd	nd	**2813**	2.45	9	5	nd	**35.25**	nd
W0196-01	Waste	No data		nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		Average of Ambient GW Quality			826	7.57	0.0	146.6	**0.5**	3.9	42	<1	**0.83**	2.2	<0.01	0.013	132	18.2	<5	389	0.21	8.9	6	1142	3.1	250
		Area weighted average			869	7.57	0.00	**147**	**0.70**	3.9	45	<1	**0.82**	2.3	<0.01	0.01	132	18	<5	390	0.22	8.92	6	**1151**	3.16	**253**
Swords	Urban Footprint Area	11.83km^2																								
No. of impacted sites		1																								
P0014-04	IPPC/CL	2007		8	1269	7.82	nd	nd	**1.67**	<1	**196**		**0.67**	1.53	0.11											
P0060-01	IPPC/CL	2007		3	1244	7.62	nd	nd	0.13	<1	137			0.52	<0.05		110	34		82	3.60	10.0	3	21	4.50	**560**
P0083-01	IPPC/CL	2004		2	805	7.48	nd	nd	0.1					4.25		<0.03										
		Average of Ambient GW Quality			1192	7.2	nd	nd	0.09	<1	117	<1	0.06	11.1	<0.01	<0.03	110	<0.002	nv	63	7.00	10.0	3	20	5.0	600
		Area weighted average			1262	7.70	nd	nd	0.13	<1	122	<1	0.07	10.76	0.01	<0.03	108	0.72	nv	62	**6.78**	9.79	3	20	4.88	**586**
Drogheda	Urban Footprint Area	12.62km^2																								
No. of impacted sites		1																								
P0164-01	IPPC	No data		-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
W033-01	Waste- Landfill	2005 (2003 for VOC)		11	822	7.43	nd	**4.5**	0.054	nd	69.5	nd	nd	nd	0.0078	0.025	nd	nd	nd	nd	0.215	6.28	nd	**214**	4.16	**129**
P0376-01	CL	2007		2	**10705**	**9.55**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**649**	nd	nd	nd	nd	**70**	140	nd	nd	nd
		Average of Ambient GW Quality			586	7	nd	69	0.025	1.3	44	12	0.12	2.46	0.011	0.038	58	4.2	<1	40	1	5.8	43	109	1.5	140
		Area weighted average			803	7.20	<1	66	0.03	1.3	44	12	0.12	2.46	0.011	<0.03	69	4.2	<1	40	0.96	7.20	44	109	<3	137

CL = contaminated land site
IPPC = IPPC facility
Waste = waste licensed facility

Location	Facility Type	Year	Mercury	Nickel	Potassium	Sodium	Zinc	Ind. Pesticide	Total Pesticide	Benzene	Benzo(alpha)pyrene	PCE	TCE	Vinyl Chloride	Total PAH	TCE + PCE	1,2-dichloroethane	Other
			µg/l	µg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
			0.75	15	5	150	100	0.1	0.5	0.75	0.075			3.75	0.01	7.50	2.25	
Waterford	Urban Footprint Area	$41.65km^2$																
No. of impacted sites		7																
P0066-02	CL	2004	nd	**15.5**	nd	nd	**323**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0093-01	CL	2007	nd	nd	nd	nd	nd	nd	nd	<1 - <20	nd	3	**403**	**22**	nd	**406**	<1 - <20	
P0157-02	IPPC	2006	nd	<20	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0385-01	CL	2008	<0.05	14.0	3.5	16	**3368**	nd	nd	<10	<1	nd	nd	nd	<1	nd	nd	
P0449-02	IPPC	2007/2008	<1	<2	**33.3**	**688**	3	0.03	0.03	<0.06	<0.5	0.06	<0.01	<0.01	<0.5	0.06	nd	
P0520-01	CL	2007 (excl MW5)	<0.05	3.4	**7.0**	30	30	nd	nd	<1	<1	nd	nd	nd	<1	nd	nd	
P0525-01	IPPC/CL	2007 and 2008	<0.05	**67.0**	1.0	18	**114**	nd	nd	<1	nd	3	<1	<1	nd	3	<1	
W0018-01	Landfill	2006	nd	12.9	nd	**455**	5	nd	nd	0.51	nd	nd	<0.5	nd	nd	nd	<0.5	
W0190-01	CL	2006	<0.05	nd	nd	nd	21	nd	nd	**660**	<0.01	nd	nd	nd	<0.01	nd	nd	
		Average of Ambient GW Quality	<0.2	7.5	2	19	23	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
		Area weighted average	<0.2	7.83	2	23	25	nd	nd	4.0	nd	0.09	9.68	0.53	nd	9.77	nd	
Dublin	Urban Footprint Area	$288.34km^2$																
No. of impacted sites		10																
P0008-01	IPPC	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0050-02	IPPC	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0078-01	IPPC/CL	2006	**3.500**	**100**	4.6	12	**261**	nd	nd	**29**	nd	nd	nd	**20**	nd	nd	**12**	
P0079-03	IPPC	2005	nd	nd	nd	nd	nd	nd	nd	<10	<10	<10	<10	<10	nd	<10	<10	
P0081-02	IPPC	2004 - 2006	0.400	1	nd	nd	98	nd	nd	<1	<1	<1	<1	<1	nd	<1	<1	
P0109-01	CL	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0111-01	CL	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0117-01	IPPC	2005	<0.1	**35**	3.7	28	29	nd	nd	<1	<1	<1	<1	<1	<1	<1	<1	
P0125-01	IPPC	2005	<0.05	<4	2.3	127	<4	nd	nd	<1	nd	<1	<1	<1	nd	<1	<1	
P0164-01	CL	2008	<0.05	14	nd	nd	84	nd	nd	<10	<10	nd	nd	nd	<10	nd	nd	
P0167-01	IPPC	2005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0217-01	CL	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0231-01	IPPC	2003/2005	nd	nd	nd	43	1	nd	nd	nd	<1	nd	nd	nd	<10	nd	nd	
P0250-01	CL	2006	nd	nd	nd	nd	nd	nd	nd	**18 (max)**	nd	**63 (max)**	**95 (max)**	**10 (max)**	nd	**158 (max)**	nd	
P0275-01	IPPC	2006	0.250	**43**	4.7	11	**259**	nd	nd	nd	nd	<1	<1	<1	nd	<1	<1	
P0284-02	IPPC	2005	nd	nd	nd	nd	**350**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0326-01	CL	2008	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**3200 (max)**	nd	
P0392-01	IPPC	2006	<0.05	6	**6.1**	30	85	nd	nd	<10	<0.01	nd	nd	nd	<0.01	nd	nd	
P0468-01	CL	No data, but no contamination	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0480-01	IPPC	2007 and 2008	<0.002	**27**	nd	nd	24	nd	nd	<1	<1	<1	**(max) 329**	<1	nd	**3.4 (max)**	nd	
P0486-01	CL	No data, but no contamination	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0522-01	IPPC	2006	nd	nd	nd	nd	nd	nd	nd	<1	<1	<1	<1	<1	<1	<1	<1	
P0532-01	IPPC/CL	2007	nd	<100	**5.0**	92	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
P0552-01	IPPC	2005	nd	nd	nd	nd	nd	nd	nd	<20	<1	<10	<10	<10	<1	<10	<10	
W0099-01	Waste	2006	nd	nd	nd	nd	nd	nd	nd	<1	nd	<1	<1	<1	nd	<1	<1	
W0127-01	Waste	2006	<0.05	6	2.7	23	7	<0.01	<0.01	<1	<1	<1	<1	<1	<1	<1	<1	
W0137-01	Waste	2004	nd	nd	nd	nd	nd	<0.01	<0.01	<0.01	<1	<1	<1	<1	<0.01	<1	<1	
W0164-01	Waste	2004 and 2005	<0.05	18	nd	nd	nd	nd	nd	<1	<1	<1	<1	<1	<10	<1	<1	
W0196-01	Waste	No data	nd	nd	nd	nd	**140**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
		Average of Ambient GW Quality	<0.1	3.7	3.2	40	42	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
		Area weighted average	<0.1	3.9	3.2	41	43	nd	nd	0.04	0.000	0.05	3.0	0.03	0.00	2.9	0.01	
Swords	Urban Footprint Area	$11.83km^2$																
No. of impacted sites		1																
P0014-04	IPPC/CL	2007						**6.99 max dichlo**	**6.99 max**	**0 max BH1**	<1	<1	<1	<1	<1	<1	<1	
P0060-01	IPPC/CL	2007	<0.05	6	**5.5**	78	42			<1	<1	<1	<1	<1	<1	<1	<1	
P0083-01	IPPC/CL	2004	<0.05							<1	<1	<1	<1	<1		<1	<1	
		Average of Ambient GW Quality	<0.1	8.0	5.6	70.0	81.0	nd	nd	<1	<1	<1	<1	<1	<1	<1	<1	
		Area weighted average	0.05	7.79	**5.48**	68.68	78.46	**0.15**	0.15	<1	<1	<1	<1	<1	<1	<1	<1	**211.33**
Drogheda	Urban Footprint Area	$12.62km^2$																
No. of impacted sites		1																
P0164-01	IPPC	No data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
W033-01	Waste- Landfill	2005 (2003 for VOC)	nd	3.91	**10.6**	30	10.4	nd	nd	0.229	nd	0.692	0.318	nd	nd	<0.1	0.166	
P0376-01	CL	2007	nd	**45**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
		Average of Ambient GW Quality	<0.2	16	2.8	41	18.4	0.4	0.56	0.06	<1	0.26	0.01	<0.1	<1	0.26	nd	
		Area weighted average	<0.2	16.3	2.90	40	17.88	0.4	0.56	<0.12	<1	0.26	<0.02	<0.1	<1	0.28	nd	

CL = contaminated land site
IPPC = IPPC facility
Waste = waste licensed facility

CDM